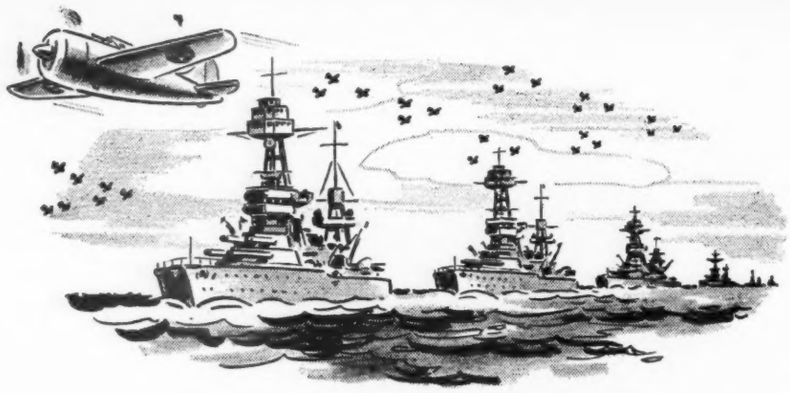
Electrical World

FEBRUARY 8, 1941

ELECTRIC COOKING BUILDS A BUSINESS



BULWARKS...

against hazards... uncertainty... chance

A two-ocean navy . . . fifty thousand planes . . . millions for tanks and guns . . . these are the bulwarks America is building to free our future from hazard or chance. So industry rolls up its sleeves, in an "all-out" effort to produce these defense armaments on time . . . while they still can prove effective. Shortly, every tool of industry will be "on the line" . . . and full, uninterrupted work output will be expected. All production hazards . . . all factors which might retard or interrupt the continuous, peak operations of machines and tools, *must be eliminated.* For when the workers of a nation *must* produce . . . *tools must not fail them!* In this "speed-up" program, with uninterrupted work flow so vital, WESTON instruments continue in their accustomed role. For these are the bulwarks behind which fighters for vital production in laboratories, factories and power plants rout error, inefficiency and waste. These are the measurement standards which have earned industry's confidence as *tools which will not fail!* Weston Electrical Instrument Corp., 578 Frelinghuysen Avenue, Newark, New Jersey.

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February 8, 1941

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McGRAW-HILL PUBLISHING COMPANY, INC.

JAMES H. McGRAW, Founder and Honorary Chairman

Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Canada, Mexico, Central and South American countries, $5 a year $8 for two years, $10 for three years. Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.
Contents copyrighted, 1941, by McGraw-Hill Publishing Company, Inc.
Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga. Cable Address McGRAWHILL, New York.

Publication Office
99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

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HOWARD EHRLICH.....Executive Vice-President
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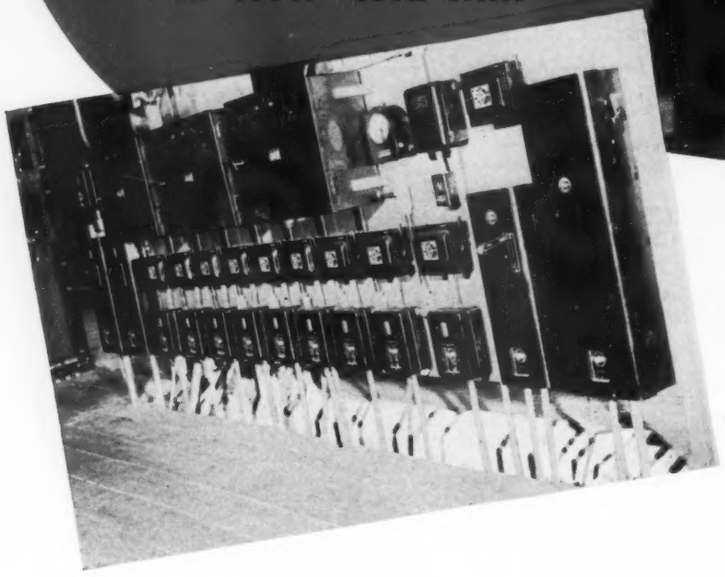
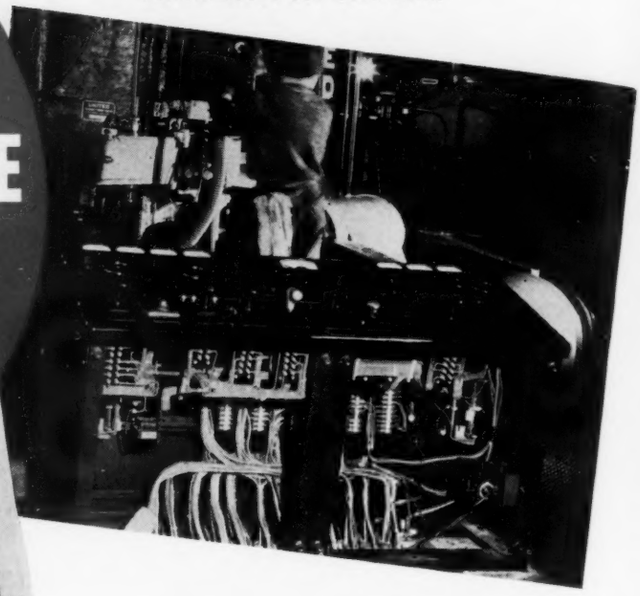
Follansbee Selects

OKONITE-OKOPRENE

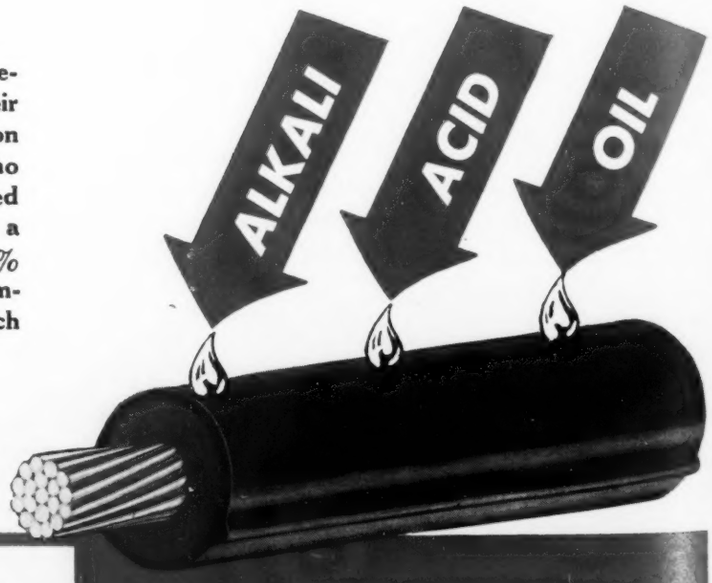
For Control Circuits in New Cold Mill





Okonite-Okoprene flame-resisting control cables at the operator's pulpit and oil circulating system control room at the new Follansbee Steel Cold Mill.

Neoprene Sheath Provides Protection from



With the installation of Okonite-Okoprene cables for control circuits of their new cold mill, Follansbee Steel Corporation joins the growing list of steel companies who have found that the combination of long lived Okonite insulation hermetically sealed in a sheath of Okoprene (containing at least 60% neoprene) provides the uninterrupted performance essential to the production schedules which must be maintained.

THE OKONITE COMPANY
Executive offices: Passaic, New Jersey
Offices in principal cities

For complete information concerning Okoprene protected wires and cables write for Bulletin OK-2009A and 2012.

OKONITE – OKOPRENE
Protected Wires and Cables

ELECTRICAL WORLD • FEBRUARY 8, 1941

A 250-Million-Dollar Baby

Ever since the depression started in 1929 this country has been looking for a market Moses to lead it out of the wilderness. Oh, if we only had another new market like radio, or the automobile—a market which would take the country by storm and restore buying and employment.

It was then that eyes were turned to air conditioning as the infant business which would expand rapidly and provide jobs for hundreds of thousands. Air conditioning has gone ahead steadily, but it has not lived up to the fancied hopes of its enthusiasts.

At the moment the new business which is really doing a job of taking up slack in employment and taxing our capacity to produce is production for defense. While many think that this is a permanent American industry, the hope of all is that the day may soon come when we shall be able to return to normal pursuits.

In the meantime there is a new non-armament industry which is going ahead like wildfire—an industry which seems to offer possibilities far greater than radio—fluorescent lighting.

On April 21, 1938, less than three years ago, fluorescent lighting was announced to the electrical industry at a meeting in New York. Its sponsors spoke of it as a new decorative tool.

At that time there were no fixtures. Nobody knew how to use this new light source or knew how the public would react. It was a business starting from scratch.

This year it is estimated by those close to the market that fluorescent lighting will involve an expenditure for lamps and fixtures and installation of 250 millions. Last year it was under 100 millions. These figures do not include any expenditures for production expansion. At the rate it is growing the first billion-dollar year can not be far away.

Strangely enough, while this new market is expanding it is not causing any apparent shrinkage in the incandescent lamp output. Last year approximately 600 million large incandescent lamps were produced—the largest year in the history of the lamp business, a gain of around 75 million lamps. The output of fluorescent lamps last year was but 7 to 10 million tubes. This year it is expected to reach 20 to 25 millions.

Obviously, of course, at the rate the new lamp is selling there will come a time before long when the upward trend of incandescent will be arrested, but even so it will continue to be a large market for a long time.

This new illuminant has given the industry the thing it has long been denied—a means whereby really adequate light can be sold. It is the beginning of the relighting of America. Through speeding up obsolescence it is creating a new and permanent market.

Once more the electrical industry is contributing to the strengthening of our national economy. Today's 250-million-dollar baby will, before many years are past, be a multi-billion-dollar giant, helping America to a restored peace-time economic health.

System Preparedness Motive of A.I.E.E. Philadelphia Sessions

Devices vie with new techniques aimed at best reliability and performance of electrical circuits and equipment — Air breakers take spotlight — Protection against primary burndowns offered

RECORD-BREAKING attendance marked one of the most energetic and diversified of the technical meetings of the American Institute of Electrical Engineers, those held in Philadelphia January 27 to 31. An unusually large number of committee meetings and informal conferences paralleled the 21 formal paper sessions, most of which are reported in highlight herewith.

Among the new things brought forth were high-voltage air circuit breakers, a family of devices to snuff out transient faults on distribution primaries, a new principle of cable design, new printing ammeter to record station loads at log intervals. Field testing of insulation was given confirming support. Reduction of generator vibration was reported. Reclosure was given a good record. A new 220-kv. line was detailed as to terminal arrangements and line features. Electric furnaces for wartime production were explored.

Ratings of apparatus for short-time intermittent duty were considered by standards co-ordinating committee No. 4 and emphasis was placed on the significance of a service factor to express the ratio of permissible continuous output to short-time rated output (*e.g.*, welding). After further discussion at Toronto in June a pamphlet is contemplated.

The instruments and measurements committee instituted a new feature. Chairman Kinnard had Professor Gray read at the Friday morning session a brief résumé of the year's and pending activities of the committee. Among them are wave form in dielectric measurements, a telemetering report, a test code for resistance measurements and an extensive review of the art of energy metering.

N. E. Funk, Philadelphia Electric; L. A. Terven, West Penn Power; Prof. C. F. Scott, Yale University; T. J. Brosnan, Buffalo Niagara & Eastern Power; J. R. Eaton, Purdue University

Governing and Stability

Prime-Mover Speed Governors for Interconnected Systems. By **R. J. Caughey** and **J. B. McClure** (both General Electric).

Proposes clarifying definitions. Concludes that dead-band should be as small as practicable, that uniform incremental regulation is desirable, the adjustable regulation is not necessary, that similar rates of response are not necessary nor is it considered important to modify designs to match characteristics because redistribution of load due to governor changes is so completely masked by real load changes.

Power System Governing—The Problem. By **J. J. Dougherty** and **A. P. Hayward** (both Duquesne Light) and **A. C. Monteith** and **S. B. Griscom** (both Westinghouse).

Reports on questionnaire aimed at crystallizing the desiderata and discusses the elements of governing. No outstanding deficiencies in modern governing systems disclosed, but full advantage is not being made of the capabilities of existing governors. However, the limitations are to be recognized and supplementary functions added when close control of frequency or tie-line load is required.

Effect of Prime-Mover Speed Governor Characteristics on Power System Frequency Variations and Tie-line Power Swings. By **C. Concordia, S. B. Crary** and **E. E. Parker** (all General Electric).

System stability suffers with too small speed regulation. Reduction of dead-band favorable to rapid stabilization of frequency and load after load change. Load damping and electrical damping conducive to stable operation. Unnecessary frequency movement or oscillation reduced by reduction of dead-band and broadening of regulation of governor mechanism on units tending to cause the unnecessary movement.

A Power-System Governor Sensitive to Frequency and Load. By **T. E. Curtis** (Pacific Gas & Electric).

Reports laboratory development of electronic control for standard hydraulic governors. Response to rate of change of frequency separately adjustable during operation. Likewise for frequency deviation. Sensitivity increased. Governor oscillation reduced. Two can be interlocked to control tie-line loads by pilot wire. Several units can be governed simultaneously by one controller.

System Load Swings. By **H. A. Bauman** (Brooklyn Edison), **O. W. Manz, Jr., J. E. McCormack** and **H. B. Seeley** (all Consolidated Edison).

Hudson Avenue station isolated and manipulated to run down causes of load swings with aim of reducing fuel losses, stoker and superheater manitenance, steam carry-over and loss in cinder catcher efficacy. Governors not found to be cause. Long time swings caused by manual operation of governor valves in un-coordinated manner during periods of load change. Short time swings (0.5 to two minutes) caused by transportation loads; automatic frequency regulating equipment has no effect on these. Two second oscillations of 3 to 5 megawatts attributed to synchronizing power swings occasioned by sudden changes in distributed load.

System Stability. By **F. W. Gay** (Public Service Electric & Gas).

Paper studies instabilities and potential correctives. Persistence of low voltage may cause trip on overspeed and shut down boiler flames and auxiliaries. It should usually be possible to force back the overspeed trip and return to governor operation. Conventional communication may prove inadequate for emergencies. Company will equip 20 generators with field adjusters to add 1/3 more field current on system low voltage. Five will have resynchronizing governors. New back-up relaying based on low voltage.

Methods of System Control in a Large Interconnection. By **Earle Wild** (Commonwealth Edison).

Centrally located frequency control plus local automatic tie-line load controllers practical in holding steady frequency. Tie-line biased-by-frequency principle relieves regulating burden on both functions. Sensitivity and per cent regulation of governors may vary inversely with size of system.

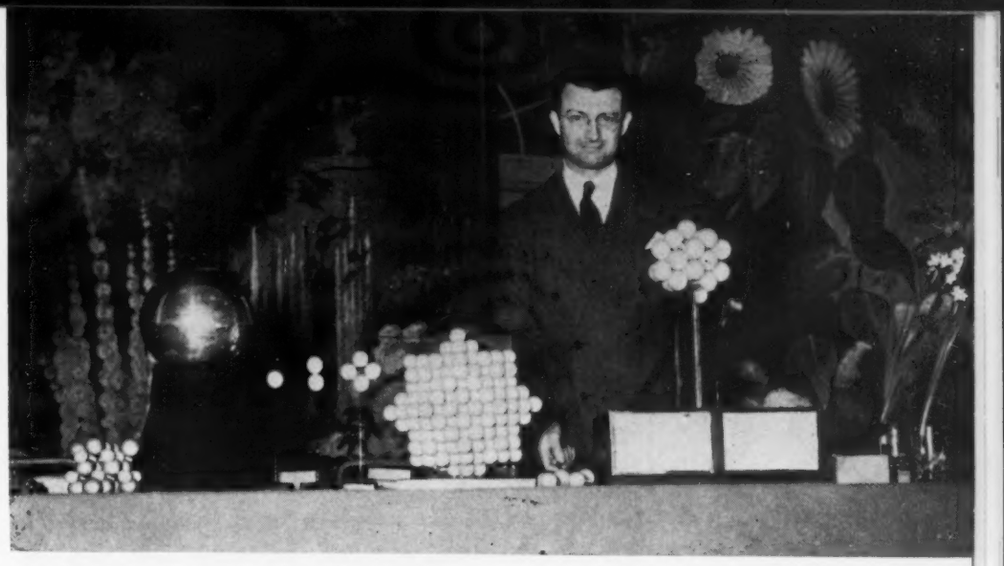
Opening the first session on power generation, chairman W. L. Cisler (Public Service Electric & Gas) said the growing defense demands emphasize the importance of problems of electric system operation such as load swings, system control and operating stability. He anticipated a wider concern over the dangers of sabotage and a consequent greater attention to guarding as plant and system facilities are realized more and more to be affected by the threat of war. He advised intensive study of conditions affecting power capacity and generation in areas where defense production is concentrated. Stating that there was no national shortage, but rather an excess, in generating capacity, he supported this assertion by giving figures of capacity now on order, 3,800,000 kw. in steam units and 2,000,000 in hydro.

There is urgent need for revision of the code for prime mover governors, said C. R. Soderberg, of the co-operating A.S.M.E. committee on control means. Particularly is it necessary to arrive at quantitative definition of terms such as "dead band," "stability," "speed of response" and others for the exact statement of performance and test specifications.

Discussing the Caughey and McClure paper, V. M. Marquis (A. G. & E. Service) said that prime mover governors had little or no effect on system stability if the system itself were of proper electrical design. The survey report paper of Dougherty, et al., gives little consideration to hydro unit governors and is therefore not fully representative of the problem, said F. W. Quarles (Cons. G. E. L. & P. of Baltimore). A. W. Kramer (Carnegie-Illinois Steel) said that in steel mill supply the problem extended beyond the governor and became one of providing adequate boiler capacity to handle load swings.

Effect on frequency change on loading was the center of discussion of the four papers in the second session on power generation. In the Chicago interconnection (Wild paper) it was observed that a 0.1 cycle frequency departure resulted in approximately a 1 per cent change in system load. Against this, the New York experience (paper of Bauman, et al.) indicates no change in load with a 3 per cent frequency change. On the Philadelphia interconnected system loading is definitely responsive to frequency change, said E. E. Brown (Philadelphia Electric), and probably the contrary experience in New York is due to a smaller proportion of induction motors in that load. J. G. Noest (Brooklyn Edison) commented on the effect of frequency regulation on boiler regulation—hunting and the probable coupling of load swings with the ups and downs of boiler regulation.

W. N. Goodridge (Consolidated Edison) said that frequency drift indicators were being installed in some stations as a means of controlling load swings not resulting from actual load changes.



Prof. Robley D. Evans, M. I. T. Atom smasher

Air Breakers, High Voltage

A Vertical-Flow Outdoor Compressed-Air Breaker. By **L. R. Ludwig** and **B. P. Baker** (both Westinghouse).

Cross-blast designs increasingly difficult with higher voltages. New design of interrupting element has vertical porcelain-clad construction for high interrupting ability. Tests indicate adequacy at 69 kva. and above. "If 14,000 amp. at 68 kv. and 5,370 volts per ms. can be successfully handled on one-half the interrupter, currents considerably in excess of 8,900 amp. at 132 kv. may be expected to carry this type far into the future kva. requirements."

A Conserved-Pressure Air-Blast Circuit Breaker for High-Voltage Service. By **W. R. Rankin** and **R. M. Bennett** (Both General Electric).

Details of 138-kv., 1,500,000-kva. air-blast circuit breaker. Uses axial blast nozzle with "conserved pressure" chamber receiving exhaust from interrupting nozzle and contains movable contact in

open position. Spring-loaded relief valve maintains pressure and dielectric strength of air in chamber at high level. Air flow through nozzle unimpaired. Two interrupting units in series for 138 kv. Entirely pneumatic action. Rates of rise up to 4,500 volts per microsecond interrupted at 132 kv.; currents up to 10,700 amp.

Both these breakers were seen by H. P. St. Clair (A. G. & E. Service) to be appropriate for high-speed reclosing, with the mechanical elements conducive to doing in a very short time the interruption and reclosing that it took decades to perfect in oil breakers. H. W. Martin and W. S. Edsall (Allis-Chalmers) cited their company's initiation of developments of air breakers in 1936 following European dictators' orders to conserve steel, copper and oil by "creating breakers relying on claybanks and air for their foundation." The company had welcomed inquiries for outdoor air breakers, but at the time had been advised that there was "no immediate need for better or faster breakers than oil types afforded." They implied that the picture manifestly had changed very quickly and that the question was whether oil breakers are really adequate and whether the industry can really afford them. H. W. Haberl (Montreal L. H. & P.) cited several successful 138-kv. airblast breakers installed on his system in 1934-36; tests are to be run shortly on four 220-kv. air breakers having six interrupters in series. They are designed to open and reclose in 20 cycles. Rubber bumpers which were all right at —20 F. were found disintegrated at —30 F.

Opportunity for use of standard wound-type current transformers was afforded by the Westinghouse design, said H. A. P. Langstaff (West Penn). He had seen the interrupting device removed (*e.g.*, for maintenance or inspection) in six minutes. His company has ordered one to be in service this year. He emphasized that many lines now trip only once in seven or eight years and breaker operating efficiency must be retained after long periods of idleness. J. B. MacNeill (Westinghouse) had urged trial installations and a subsequent session to discuss progress and results. Points emphasized by him were the arrangement of disconnecting switch contacts, interlock between interruption and disconnect functions, impulse characteristics at time of opening and the protection against moisture.

Air Breakers, Low Voltage

A new Air Circuit Breaker With 250,000 Kva. Interrupting Capacity. By **R. C. Dickinson** and **R. H. Nau** (both Westinghouse).

Magnetically enhanced diffusion of ionized particles applied in evolving 250,000 kva. rating from 150,000 kva. (shown to have ample margin). Above several thousand amperes arcing-time is one-half cycle, at 600 amp. is 4 cycles, at 14 to 20 amp. about 22 cycles and at 1.6 amp. ½ cycle. Design appropriate for 4–5 kv., for repetitive service and for metal-clad gear.

Geometry of Arc Interruption. By **E. W. Boehne** (General Electric).

Shown that arcing phenomena can be controlled to reduce initial recovery voltage and rate of rise to small value. In air breaker 90 deg. lagging current can be rephased to leading at current zero in less than one cycle. Announces extension of "Magne-Blast" air breakers to 7.5 kv., 250,000 kva., with rapid extinction of light currents.

That one entire session was devoted to air breakers reaching now up to 138 kv. was taken to indicate the rapid progress being made in the evolution and extension of this oilless form of circuit interruption. Anticipation of many of the principles in the new low-voltage breakers by the earliest pioneers was cited by D. C. Prince (General Electric), and although the explanations of action of the two makes of breakers may differ they both add to the versatility of arc interruption and each has its place.

Joseph Slepian and R. H. Nau (Westinghouse) had taken issue with the circle diagram representation of arc energy in the Boehne paper and Slepian said he preferred to aim for low arc energy because it is not readily possible to get low arc energy in magnetic acceleration of interruption. Nau, in closure, cited a 10- to 12-in. arc length in the Deïon pattern against a value up to 36 in. or even more for the Magne-Blast. Doehne in his closure said arc energy can be large but still give better interruption if recovery voltage is reduced or offset.

Power Fuses

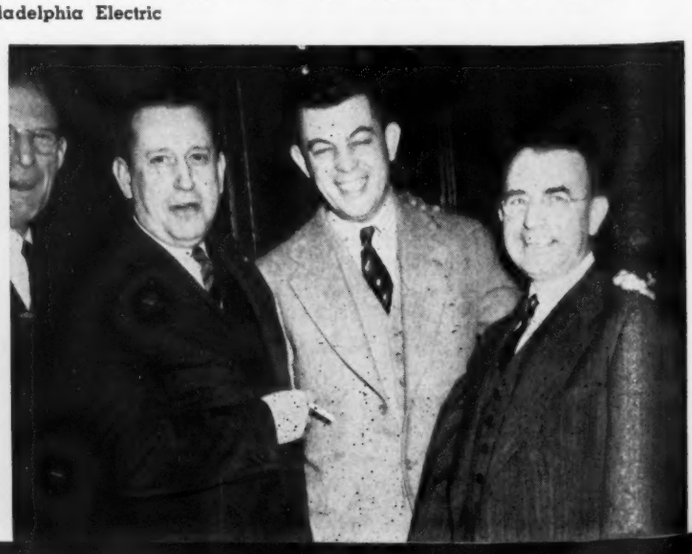
Control of the Switching Surge Voltages Produced by the Current-Limiting Power Fuse. By **E. A. Williams, Jr.**, and **C. L. Shuck** (both General Electric).

Recommends that fuses be designed to control switching surge voltage magnitudes thus: (1) Transient recovery voltage should not exceed insulation level of rotating machines, (2) should not exceed 60-cycle crest spark-over of associated lightning arresters and (3) then the interrupting rating of fuse should be assigned to limit the arrester current to a safe magnitude. Practicable results reported through use of conducting elements with uniform sections of different diameters.

The Protective Link. By **J. K. Hodnette** and **M. G. Leonard** (both Westinghouse).

Internally mounted in distribution transformers, it disconnects them in case of internal fault. Heavy currents expel lower terminal. Efficient arc quenching up to 250,000 kva., single-phase interruptions in one-half cycle. Successful operation of the principle reported for high side of 33/4 kv., 1,000-kva. three-phase unit in connection with 5-kv. breaker on low side,

H. J. H. Huber, General Electric; M. M. Samuels, REA; G. M. Ruoff, Locke Insulator; Al Herzberg, Wagner Electric; H. P. Sparkes, Westinghouse; L. C. Hollands, RCA; George Van Antwerp, Philadelphia Electric



with breaker arcing across open contacts when wind crossed 33 kv. with 4 kv.

On the protective link, S. R. Smith and C. R. Craig (General Electric) sent in the comment that the device operates in the transfer oil somewhat explosively and that transformer tanks are normally not made to withstand inordinate internal pressures. Variations in the amount of air trapped in the inclosing tube would, in their estimation, greatly affect the melting time-current characteristic. They seemed to find an inconsistency between the field experience as to transformer winding breakdowns and the theory advanced in the paper. G. F. Lincks (General Electric) said that renewable fuse links for expulsion cutouts have been developed with an accuracy approaching the high standard set by overcurrent relays with resulting gains in co-ordination.

Blowing of small capacity links does not affect the sustained accuracy of large ones in series with them. It would seem that comparable accuracy is required of the protective link. He also questioned the low-current operation on account of the effect of tube carbonization, nor did he think it was necessary to use metals with high melting temperatures to attain the author's objectives.

E. A. Williams (General Electric) mentioned the need for dismantling of the transformer to renew an internal fuse. In rebuttal, M. G. Leonard said pressures caused by protective link blowing were not high enough to cause concern about the tank, nor was there the kind of damage to the fiber tube feared by Lincks.

Transformers; Bushing

Field Power-Factor Testing of Transformer Insulation and Operating Experience. By **E. W. Whitmer** (American Gas & Electric Service).

Three Doble sets in continuous use on up to 1,400 transformers (11 kv. up) annually. Not necessary to disconnect bushings to locate defective bushing. Transformers tested every 2½ years. Tests take one hour for bank of q-winding units. Nine out of ten high p.f. values traceable to moisture, others mostly high p.f. oil. Moisture generally distributes throughout winding. Windings above 5 per cent (but 6 per cent for C.T.) are tagged "remove." Failure rate high for windings not removed soon after disclosure of high p.f. Computed savings of $50,000 from prevention of 100 cases of $500 repairs as result of analysis of tests on 5,000 transformers.

W. C. Hoover, Electric Storage Battery; F. E. Fairman, General Electric; W. W. Edson, Boston Edison; Azel Ames, Kerite; K. W. Green and E. C. Kline, Exide

Bushing and Associated Insulation Testing by the Power-Factor Method. By **C. C. Baltzly** and **E. L. Schlottere** (both Philadelphia Electric).

Three modern Doble sets in use. Important location units tested annually. About 4,000 bushings annually; 1,493 have been rejected in five years. Bushing shop has reconditioned 1,884 (7.5 to 73 kv.) in five years. Top gaskets replaced on nearly 1,000. Wood cross braces, A-frames, lift rods also reconditioned. Several hundred arresters reconditioned; broken castings, defective seals, internal corrosion. All rejected equipment has disclosed faults warranting removal. Costly emergency repair jobs averted.

Over the history of field testing the tolerable limits of insulation power factor have been steadily lowered and failures have been progressively reduced by intelligent analysis of the cumulative information, said F. C. Doble. Meanwhile the power consumption of the field equipment has been reduced so that 17 amp. at 110 volts suffices where 200 amp. might once have been needed for 10-kv. tests. Field data, said I. W. Gross (American G. & E. Service) can be made to disclose the point of defect in composite insulation. Indicated rejections are almost invariably justified.

Power-factor testing shows the permanence of seals to keep moisture out of small transformer tanks, asserted C. I. Pearce (Philadelphia Electric). M. S. Oldacre (Commonwealth Edison) said moisture is the crux of the insulation situation and that energetic sealing of all equipment against moisture would render power-factor testing largely untenable.

Primary Burndowns

Power Arc-over on Overhead Distribution Lines and Newly Developed Equipment for Protection Against Conductor Burndown From That Cause. By **G. A. Matthews** (Detroit Edison).

Based on comprehensive analysis of arcs and conductor burndowns there have been developed three new protective devices. One is a metallic-shorting contactor to collapse voltage and extinguish arcs; initial opening then by instantaneous tripping; located short distance out on line; ½-cycle action. Another (for lower capacity circuits without breakers) also includes its own interrupter to break the artificial short circuit; fuses clear if arc re-establishes on lock-out. The third (for suburban and rural circuits of fairly large capacity) incorporates fully automatic reclosure in oil with self-timing.

Distribution, particularly the primary system, is the place to spend money for outage reduction, said D. K. Blake (General Electric). Snuffing out of transient faults would constitute an economic and psychological gain, said H. L. Wallau (Cleveland), and he welcomed the prospective low cost of the Matthew devices.

G. F. Lincks (General Electric) felt that distribution has outgrown the protective orbit of the substation relay and breaker, but that the sectionalizing trend has added to service protection. To the fuse manufacturer the Matthews devices pose a problem, he said, of providing a line of slow link fuses along with a line fast enough to do a job similar to his shorting contactor.

For flat three-phase construction A. H. Kidder (Phila. Electric) saw

the opportunity to use a single-pole interrupter in the middle wire and fuses in the outer ones. Philip Sporn (A. G. & E. Service) saw in them a move to accomplish in a few cycles what took whole seconds to accomplish fifteen years ago. H. P. St. Clair of the same company was interested in the extent to which the shorting contactor increased the fault current. Extensive justification of the Matthews devices seemed somewhat dubious in light of typical Chicago experience (with possibly fewer trees as a factor) of only one-fifth the primary burndowns of the Detroit isolated delta system.

Generator Insulation

Field Testing of Generator Insulation. By **E.E.I. Subject Committee on Generator Insulation and Testing.**

Insulation resistance-time curves valuable index in drying-out. Ratios of insulation for various d.c. voltages found promising index of dielectric condition. Voltage effect greater at lower temperature and higher moisture content. Power-factor tests not found to be indicative of incipient failure nor have 60-cycle ionization tests. Old armatures found to have high dielectric strength. End-turns usually weaker than slot-sections.

F. C. Knowles (Evershed & Vignoles, London) was called on and confessed there was relatively little interest stirring in elaborate testing of generator insulation in England. Rather, they rely there primarily on spot tests before and after operation to disclose, in conjunction with temperature and humidity corrections, any drift toward fewer megohms.

Spot readings might be misleading at times, admitted W. B. Craigmile (Biddle Company); however, they are often the only kind that can be made or justified, particularly for small machines.

M. S. Oldacre (Commonwealth Edison) suggested more attention to the possibilities in high-frequency tests across coil terminals.

Power Distribution in Industrial Plants

Secondary Networks to Serve Industrial Plants. By **C. A. Powel** and **H. G. Barnett** (both Westinghouse).

Networks can compete with radial distribution in economy, reliability and flexibility. Physical location of machinery less a factor than total connected load, diversity factor and over-all power factor. Load densities in exceptional cases up to 100 kw. per 1,000 sq.ft. (more usually 10 to 20, equivalent to 280,000–560,000 kw. per square mile). Network becomes more decisively economical as total loads pass 500 kw. Reliability gained by grid which is supplied by all feeders; loss of transformer or feeder not disastrous to production. Typical example detailed.

Inclosed Bus-Bar Electrical Distribution Systems for Industrial Plants. By **E. T. Carlson** (Trumbull Electric).

For main feeders in current ratings up to 4,000 amp. and for obtaining convenience outlets in current ratings from 125 to 1,000 amp. Discusses inductance, proximity effect, skin effect inductance and voltage regulation with charts for GMD and reactance.

Short-Circuit Calculating Procedure for Low-Voltage A. C. Systems. By **A. G. Darling** (General Electric).

Gives comprehensively for the industrial electrical engineer the methods familiar to power system engineers for computing short-circuit currents and transients for the purpose of selecting adequate protective and control apparatus. Author drew upon other G.E. experts for component parts, particularly the extensive calculating data in the elaborate appendices.

That energy supply reliability would be at its best by using a secondary network in an industrial plant was the one point of agreement in the discussion of the Powel-Barnett paper. D. L. Beeman (General Electric) thought that the generally lower cost and greater simplicity of operation of radial distribution would in many cases overbalance the reliability feature of the network. W. E. Knause (Philadelphia Electric) pointed out the values of intertied or sectionalized loop primaries for large industrial distribution. William Edson (Boston Electric) remarked upon the possibilities of regeneration from elevator and other motors in like service, wondered about maintenance and cleaning of a large number of air-cooled transformers and suggested that equal reliability might be obtained by banking radial secondaries through reactors. In closing, Mr. Barnett reconciled all difficulties by observing that the relative values of network and radial distribution depend on what was wanted in terms of operation, of reliability of supply and of cost in the particular case.

Discussing the Carlson paper, O. R. Schurig (General Electric) presented the results of impedance and loss measurement tests of "Bus-Wa" assemblies. The Schurig data include the r.m.s. line-to-line drop, the three-phase loss, the impedance per phase, the average effective resistance per phase, the reactance per phase, the calculated value of impedance, the d.c. resistance, the average a.c.-d.c. resistance ratio and other factors for one and two $4 \times 1\frac{1}{4}$ bars per phase conductor. H. B. Dwight (M. I. T.) offered suggestions for calculations of values in this type of industrial distribution.

The Conference on Power Distribution in Industrial Plants emphasized that the Committee on Industrial Power Applications has a whopper of a job on its hands. Some of the matters touched upon in the conference were:

Relative value of service reliability in each case of industrial distribution; safety aspect of adequate short circuit capacities in breakers; paucity of engineering talent in average industrial plants; calculation and test determinations of short-circuit currents; lack of agreement between calculated and actual short-circuit

J. H. Burke, American Gas & Electric Service Corporation; D. P. Orcutt and H. H. Hudson, Electric Storage Battery; I. W. Gross, American Gas & Electric Service Corporation

values as proved by fact that faults are not usually so destructive as calculations indicate; failure of industrial management to appreciate electrical engineering problems; how, economically, to justify cost of rehabilitation and of new equipment when the old installation is apparently performing satisfactorily; the unappreciated importance of adequate and reliable electricity supply in continuous industrial production as required by the present emergency for defense.

From the discussion of these matters in their many ramifications there emerged some suggestions to the committee. They were that local A.I.E.E. sections should form and foster industrial power groups; short-circuit data should be worked up for, and presented in terms intelligible to, the industrial plant engineer; studies should be made and published on electrical engineering in vertical classes of industrial plants; the committee should decide how high or low its sights might be in dealing with the problem of electrical engineering in industry.

New Cable

A New Principle of Cable Design. By **W. A. Del Mar** (Phelps-Dodge).

Since instability of cable insulation results from ionizable voids caused by load-cycle deformation, the new cable has inner and outer layers of paper with different moduli of elasticity, the outer compressing the inner. Tension of application is same for all layers. Stabilized power factor results. Impregnant a paraffin base oil with synthetic derivative of wood rosin.

Hardly a cable producer was not represented in the discussion of the tight-wrap cable described by W. A. DelMar. Since the theory advanced for the cable is based upon the differences in properties of the two types of paper, L. F. Hickernell (Anaconda) felt more data should have been given about the special grade employed. Shrinkage tensions in drying might well, he felt, mask the small difference in elastic moduli. Also, he said, the author let the reader speculate on the matter of power factor after 50 loading cycles; it was Hickernell's estimate that prolongation of the tests would show the same behavior as the Scott (British, 1939) inverse-graded cable. It would also have been desirable, he said, to report power factor data for 80, 100 and 115 C. as well as 60 C.

Whether temperature would rise fast enough to maintain paper tightness against viscous migration of impregnant was a doubt expressed by H. H. Race (General Electric). K. S. Wyatt (Phelps-Dodge) replied that deformation is the least when paper with the greatest modulus is in the outer wraps. Herman Halperin (Commonwealth Edison) wrote that the viscosity of the compound at 80 C. is about the same as cable oil at 30 C. L. R. Komives (Detroit Edison) asked why not use varying thickness of paper rather than varying density.

Skepticism about Mr. DelMar's theory and general significance of the data was expressed by E. W. Davis (Simplex) as well as on permanence of the graded elasticity objective after many load cycles. C. F. Borshneck (Phelps-Dodge) said the tight construction has improved conditions in the filler areas of belted cables. T. F. Peterson (American Steel & Wire) attributed the reported results to reduction of stress oil in gaps near the conductor. R. T. Atkinson (General Cable) would expect cumulative one-way migration outward from the conductor with successive loading cycles. R. J. Wiseman (Okonite) was not sure that the reported results were not due more to favorable shape of the conductor than the graded moduli.

In closure Mr. DelMar said any form of solid cable is sure to fail ultimately and there is thus justification for any plausible effort to get demonstrably lengthened life whether a supporting theory can be set up or not.

Lightning on Transmission

Experience With Preventive Lightning Protection on Transmission Lines. By **S. Waldorf** (Pennsylvania Water & Power).

Six years and 3,289 observations on 66- to 220-kv. lines lead to conclusions that no sections are immune, that strokes run 126 per 100 miles per year, that flashovers can be caused by the reactive drop for heavy tower leg currents, that no advantage accrues from reducing footing resistances below 6 ohms, that shielding in the 66-kv. lines is effective for 98 per cent of strokes, that shielding plus counterpoise is 100 per cent effective on 220 kv. and 98 per cent on 66 kv. Arresters on such lines are seldom called upon to carry lightning discharges. Tower leg distribution is symmetrical only for heavier discharges.

Improvement could be made in the definition of efficiency of protection against lightning, in the opinion of G. D. Floyd as conveyed by A. H. Frampton (Hydro of Ontario); as used by Waldorf a high value may be obtained in the index even where no particular effort has been made to attain immunity. He cited 20 outages (all but one at towers of more than 5 ohms) on a 103-mile, 110-kv. circuit built without ground wire installed but now likely to have one shortly at 25 ft. above the center conductor.

E. H. Grosser (Commonwealth Edison) felt there was more chance of accurate prediction of outage on medium-voltage lines than for high-voltage lines designed for minimum outage.

H. B. Gear, Commonwealth Edison, and Charles E. Brown, Jr., Okonite

New Transmission

Powerton-Crawford 220-Kv. Line: System Operating Features and Terminal Design. By **H. E. Wulfing** and **T. G. LeClair** (both Commonwealth Edison).

Line designed to operate continuously near static stability limit (150,000 kv.). The 180,000-kva. bank at Powerton has two 22-kv. primary windings connected to different buses. At Crawford terminal there is a four-winding transformer (150,000 kva. at 220 kv.; 75,000 kva. at 12 kv., two 90,000 kva. for separate 66-kv. systems). No 220-kv. breakers at either end. Carrier will provide breaker tripping, telemetering, load control and communication. A 75,000-kva. synchronous condenser at Crawford can be used to energize the line, being driven by a 3,750-hp. motor. New link intended for high reliability of supply in Chicago area.

Powerton-Crawford 220-Kv. Line: Design and Construction Features. By **M. S. Oldacre** and **F. O. Wollaston** (both Commonwealth Edison).

Right of way mostly 250 ft., room for future circuit, elsewhere narrow. Designed for 150 m.p.h. wind. Conductor 900,000 circ.-mil ACSR. Corona voltage 300 kv.

Glaze melting impracticable so line uses two varieties of tower, one for normal spans and another for long spans, each to afford wide separation against galloping conductors. Two ground wires. Protective angle not more than 20 deg. Eighteen disks (10 x 5¾ in.) found 10–18 per cent cheaper than 6 or 6½ in. Pyramid earth anchors for tower footings. Discontinuous parallel counterpoise. Stockbridge dampers on ground wires and conductors plus armor rods on conductors. Conductors largest ever installed by pulling out under tension.

Inductive co-ordination of the line with those of the telegraph company was found readily possible at moderate expense, said J. W. Milnor (Western Union). Driven ground rods adjacent to tower legs are useless unless driven substantially deeper than footings, said E. W. Hansson (Pennsylvania Water & Power), citing experiments conducted in 1923 and 1931.

But in his closure Wollaston found 10-ft. rods driven from the bottom of 10-ft. anchor holes did materially reduce footing resistance. T. G. LeClair said the line would be operated close to its stability limit and that the reason for an extra spare unit at Powerton was the lack of men who, at Crawford, were available to move it into place to replace a faulty unit.

Wave Distortion: Meters

Automatic Printing Ammeter. By **T. G. LeClair** (Commonwealth Edison).

Records in numerals, at predetermined time intervals, ampere loading on 50 different circuits; also totalizes groups. Constitutes mechanical log sheet for unattended stations or to relieve operators of the task in attended stations. Single element functions in rotation to successive circuits. Solenoids actuate type bars carrying the numbers. Totalization superior to analysis by despatcher of log sheets with load data for paralleled circuits normally scattered over log sheets in replica of board arrangement.

Magnetic Fields in Watt-Hour Meters. By **C. A. Keener, M. A. Faucett** and **M. S. Helm** (all University of Illinois).

Registration errors for three makes of meters found within permissible calibration errors so long as the current distortion factor does not exceed 30 per cent. Meters run slow on peaked current waves and fast on flat-topped waves. Error increases sharply after 90 per cent distortion. Error is uncertain if potential distortion is the result of impedance drops caused by distorted currents because the time relations depend on circuit conditions.

The consensus here was that harmonics have to be numerous and potent before accuracy of watt-hour meters is materially affected. That they can be both numerous and potent was indicated by W. J. Smith of REA, who told of an 800-mile co-operative fed by a generator with 24 per cent voltage distortion that led to 105 per cent distortion of current, due to capacitive accentuation of harmonics. The distorted current is carried by the substation meter but not by the consumers' meters.

H. E. Trekell (General Electric) reported negligible errors for the 11 per cent distortion attending 97 per cent power-factor fluorescent units. Peaked waves tend to show more appreciable errors than flat-topped combinations. L. A. Doggett (Penn State) reported finding errors up to 12 or 15 per cent, however, on polyphase meters through which capacitors were fed.

Power Line Carrier

Inductive Co-ordination of REA Distribution Systems and Telephone Systems. By **K. J. Plucknett** and **W. T. Smith** (both R.E.A.) and **T. A. Taylor** (Bell Telephone Laboratories).

Co-operative studies fruitful. Electric rurals average 350 miles (of which 90 are three-phase) with 5 kva. of transformers per mile. One million miles ultimate prospect. Unnecessary exposures avoided. Magnitudes of harmonics restricted in generator specifications. Transformers with low harmonic exciting currents selected. Shunt capacitors improve wave shape. Wave traps in substation neutrals to lessen residuals. Hold line voltage to normal by regulators or auto-transformers to lessen harmonics in transformer excitation at overvoltage.

Power-Line Carrier Communication. By **J. D. Booth** and **A. P. Bock** (both Westinghouse).

Describes improved single-carrier frequency automatic simplex system for up to 10 transmitter-receiver units, each called by dialing. Transfer between sending and receiving functions accomplished by automatic voice control using electronic relays. Systems in service.

A million dollars has been spent by TVA for carrier installations, said Llewellyn Evans, and one-fourth of it went for the type described. It can be used interchangeably with General Electric equipment. Carrier performance on TVA is much better than most power engineers had believed possible. The adjustments are effective regardless of switching of tap lines, he said. A General Electric representative said that seventeen years of experience had failed to present for logical consideration a line which was wholly unsuited to carrier in any form.

Electricity for Processing Metals

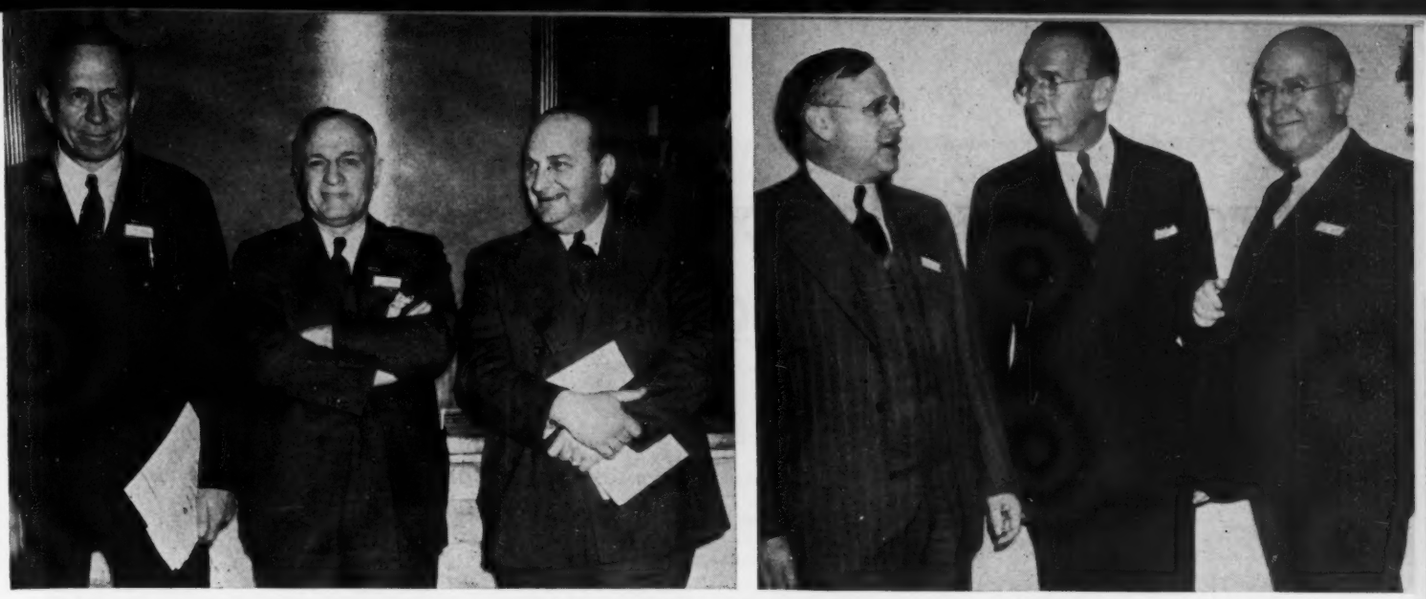
Large Electric Arc Furnaces—Performance and Power Supply. By **B. M. Jones** and **C. M. Stearns** (both Duquesne Light).

Analyzes tests on two 25-ton steel furnaces. Removal of reactance (separate from transformer) led to slight excess over standard 1.5-volt fluctuation (115-volt base) on 66 kv. but without complaints or excessive operation of 4-kv. distribution regulators. Interlocking found needed only for demand limitation. Synchronous condenser provides compensating kvars with aid of buffer reactor. Strength of condenser field found to have little correction on rapid furnace reactive changes.

Electrolytic Process of Scale Removal from Steel. By **H. W. Neblett** (Inland Steel).

Flat rolled steel descaled in sulphuric acid pickling line. Electrolytic process superimposed. Requires 100–150 amp. a.c. per square foot. Graphite slabs for electrodes: Twelve used (4 ft. 2 in. x 6 ft. 6 in.) in tank for 44-in. strip. Transformers give 15 to 7 volt range with three secondaries. Conductor leads insulated with glass tape impregnated with material like "Koroseal." Two minutes for 200-ft. strip at 100 f.p.m. Load is 600 kw.

Following presentation of the Jones and Stearns paper by Mr. Jones, Mr. Stearns presented additional data obtained since the paper was written. These later data corroborate the conclusions of the paper—that two furnaces cause fewer load swings than one and that flicker difficulty is not great. L. W. Clark (Detroit Edison) compared experience in Detroit with that recounted in the paper and said that the bigger furnaces were the easier to serve so far as load swings are concerned. Samuel Arnold (American Bridge) said that 12,000 kva. for 60 cycle and 15,000 kva. for 25 cycle were about the limits for single furnaces because of reactance in leads and of the duty put on linings by large heat absorption. O. B. Falls (General Electric) suggested use of system data collected for short-circuit studies for investigating the effects of furnace load swings. N. R. Stansel (General Electric) developed equations of maximum current input to furnace arc in terms of reactance of the circuit showing that while adding reactance reduces flicker it also reduces revenue. S. B. Griscom (Westinghouse) implied he would like to see the data of the paper presented



Paul B. Juhnke, Commonwealth Edison; Mark Eldredge, OPM, Washington; Paul von Wagner, Copperweld; Harold Cole, Detroit Edison; Claude Matthews, W. N. Matthews Corporation; H. P. Seelye, Detroit Edison

in single-phase quantities, since flicker is a single-phase trouble.

Grounds; Pole Tops

Impulse and 60-Cycle Characteristics of Driven Grounds. By **P. L. Bellaschi** (Westinghouse).

Presents test data. Shows ratio of impulse to 60-cycle resistances ranging from unity at small impulse currents to 0.60 at 7,500 amp. crest. Crest voltage precedes crest current by one or two microseconds. Inductive effect of leads or tower leg may prove to be "a factor of primary importance in lightning protection."

Minimum Insulation Level for Lightning Protection of Medium-Voltage Lines. By **H. N. Ekvall** (Philadelphia Electric).

Six-year results of renovizing 13- and 33-kv. wood-pole lines. Power arcs found the principal cause of trouble; arc-over paths lengthened after analysis of 20,000 pole-top paths. Susceptibility curves plotted. Minimum insulation level of 2 in. per kv. adapted for 33 kv. and 3.5 for 13 kv. Guys removed, relocated or insulated. Wood braces replace metal. Insulation inserted in gang-operated air-break switch bars. Ridgepin raised by extension or by lowering crossarm. Result has been 75 per cent reduction in lightning outage on 13 kv. and 62 per cent on 33 kv.

Lesser ground resistance to impulse was attributed by H. M. Towne (General Electric) to high resistance sparking near the electrode. He felt that poor (200-ohm) grounds might show a 70 per cent reduction, while 5-ohm grounds might be only 10 per cent better on impulse than at 60 cycles. J. H. Hagenguth (General Electric) urged that the paper do not tempt engineers to relaxation of prevailing efforts to improve grounds, particularly where high rates of voltage rise are characteristic.

Frequency of faults on 34-kv. lines of Public Service of Northern Illinoise (reported by F. E. Andrews) varied widely from those in the Philadelphia paper, but the departures were merely construed as indicative of the complexity of variables involved (*e.g.*, difference in span lengths).

H. K. Sels (Public Service, Newark) concurred in the chosen minimum of 2 kv. per inch of wood path for 26 kv. Against the 62 per cent reduction in flashovers the New Jersey company gets 92 per cent, the gain presumably coming from the use of fifteen protector tubes per mile on the ridge-pin conductor.

Reclosure; Bushings

Surges on Chicago 12-Kv. System. By **F. O. Wollaston** and **H. J. Plumley** (both Commonwealth Edison).

Analyzes 20 years of records of overvoltages. Maximum about 3.5 times normal crest. Highest transients occur not at switching-clear, but at fault inception. Essentially power-frequency phenomena. Confined to metallically connected parts. Secondary failures occur only on insulation deterioration to point of not withstanding 60-cycle overvoltage 1.73 times normal crest to ground or a few cycles of transient overvoltage up to 3.5 times crest. Little difference between overhead and underground.

Five Years' Experience With Ultra-High-Speed Reclosing of High-Voltage Transmission Lines. By **Philip Sporn** and **C. A. Muller** (both American Gas & Electric Service).

Out of 71 cases of flashover, 65 reclosures were successful and six resulted in restrikes; 33 installations. Actual performance better than was anticipated. Further improvements possible by further reduction of breaker time. No mechanical failures. Probability of restrike on double-circuit lines approximately four times as great as for single-contact flashovers. Hopeful that percentage of two-line flashovers can be reduced by increasing speed of fault clearing and that restrikes will decrease if reclosure can thus be delayed correspondingly.

Report on Apparatus Bushings. By **A.I.E.E. Joint Committee on Bushings.**

Adds to previous report a tabulation of proposed requirements for indoor and outdoor apparatus bushings rated 2,500 volts up, excluding wall and roof bushings, potheads, etc. All values are withstand-test without negative tolerance. Either positive or negative waves, whichever give lower value. Range 1.2 to 345 kv.

High-Voltage Bushings Designed to Meet Modern Service. By **T. F. Brandt** and **H. L. Rorden** (both Ohio Brass).

Reviews evolution of bushings culminating in full-compression assembly which automatically keeps gaskets oil-tight (by spring in oil reservoir), stabilizes dielectric properties of oil by excluding sunlight, moisture and oxygen and allows for oil expansion with temperature changes. Magnetic oil-level indicator available for the larger bushings.

The Petersen coil was called by E. T. B. Gross (Cornell) the likeliest competitor of ultra-high speed reclosure. He cited 88 per cent reduction in outages on a 190-mile, 23-kv. system in Czechoslovakia after their installation. But Sporn countered with the disadvantage of having to change Petersen coil taps with every material change in system configuration. On subtransmission he looks to see a trend toward solid grounding with consequent favoring of ultra-high speed reclosing over the Peter-

[*Continued on page 144*]

Traveling Capacitors Are Versatile Tool

Trailer-mounted capacitor assembly provides a total of 1,080 kva. in 180-kva. steps for voltage control on 2,300- and 4,000-volt circuits — Protective equipment, safety devices included in service-tested unit

GLEN APPLEMAN,* Pennsylvania Power & Light Company

ORIGINALLY purchased for voltage-control service during emergencies, a portable automatic capacitor unit that provides up to 1,080 kva. has proved of real value in maintaining continuity of service on both 2,300- and 4,000-volt circuits where repair or changing of equipment is under way. In this capacity it has saved a great deal of overtime on work that would have had to be completed in off-peak load periods.

It is also expected that our commercial department will use this unit to show larger consumers the benefits of power-factor improvement. Moreover, it has been suggested that the equipment be temporarily installed in various situations requiring voltage improvement—possibly through the use of capacitors—to determine more accurately the rating of the necessary capacitors, rather than to depend entirely on calculations. In such installations recording instruments will be used to determine just what portion of the day requires the maximum voltage improvement and just how much of the capacitor unit was in the circuit during that period.

Weatherproof Housing

The mobile capacitor is made up of 72 standard 15-kva. single-phase Pyranol capacitors, suitable for operation delta-connected for 2,300 volts, three-wire, three-phase, 60 cycles, or wye-connected for 4,000 volts, four-wire, three-phase, with the necessary switching and automatic control equipment. This equipment is installed in a weatherproof housing—provided with adequate ventilation to prevent moisture condensation on the equipment inside—mounted on a trailer. Installation requires no more work than unrolling the 150-ft. cable and connecting to the 2,300- or 4,000-volt bus or line and the unblocking of certain relays that are blocked to prevent damage to them in transit.

The capacitors are mounted in three three-phase groups—one group of twelve provides 180 kva., a second group of 24 provides 360 kva. and a third group of 36 provides 540 kva. Each group is made up of three single-phase sections which may be connected in either delta or wye three-phase banks by double-throw disconnect switches of stud-and-link type. Each capacitor is provided with outdoor bushings and two removable and accessible fuses.

Capacitance is cut in or out in 180-kva. steps by three oil switches or contactors which are automatically closed or opened as greater or less correction of voltage is indicated by a contact-making voltmeter on the control panel. The voltage relay is adjusted both as to level at which voltage is to be maintained and as to width of belt between which voltage may vary before capacitance change is made. Provision is also made for a variable time delay between the occurrence of a voltage change and the initiation of a switching of the capacitors so that sudden voltage changes of short duration will not cause unnecessary switching.

All the equipment inside the switchhouse is connected on the load side of a manually operated oil circuit breaker rated at 400 amp., 7,500-volt, 50,000-kva. interrupting capacity, and provided with two 3-amp. a.c. trip coils and one 115-volt, 60-cycle potential trip coil in a three-coil coverplate. When this main breaker is open nothing but the lead-in cable and half of the circuit breaker is alive. It is not necessary to remove the oil from any of the switch tanks when the capacitor is moved, since all the switches are of a new type developed by General Electric that have proved splash-proof in transit.

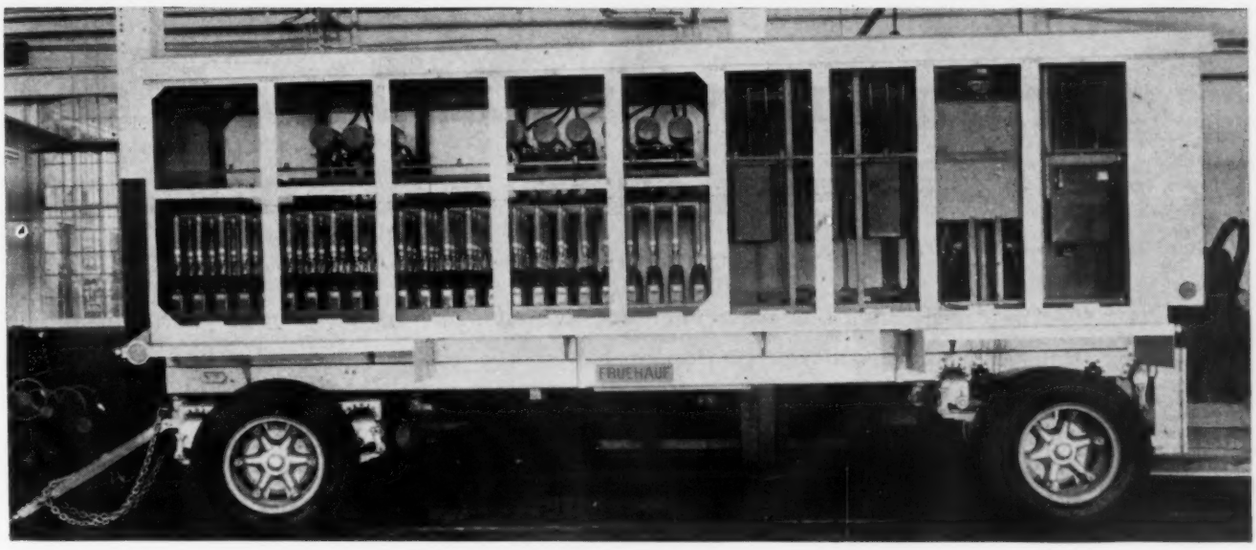
Overload Relays

On an overload the main circuit breaker is tripped by two inverse-time-limit overload relays with a calibration range of 3 to 10 amp. mounted on the switchboard panel. Secondaries of the three 300/5-amp. current transformers are Z-connected to trip on overload for three- or four-wire service, using the two trip coils.

Power supply for the group switches is obtained from an operating transformer rated at 2,300/115–230 volts. There is also a potential transformer rated at 2,300/115 volts. These are equipped with a primary cutout and fuses and with a double-throw disconnect switch with which one primary lead can be connected to one phase conductor for 2,300-volt operation or to the neutral for 4,000-volt operation.

Three standard line-type lightning arresters are installed inside the switch house and connected, one to each phase, at the oil circuit breakers. They are connected on the load side so that they also will be disconnected in case of a failure of, or leakage

* Grounding engineer.



over, these arresters and are grounded to the frame of the housing.

Cable Leads

Connected to the line side of the main oil circuit breaker are the cables. Phase cables are single-conductor, 250,000-circ.mil flexible conductors of approximately 250 strands each and are insulated with 6/32-in. wall of not less than 30 per cent pure rubber compound and two heavy seine twine weatherproof braids. In addition, there is a No. 2/0 flexible conductor of approximately 125 strands of single-conductor cable each for the 4-kva. neutral and for the grounding cable. These are covered with standard 600-volt code rubber insulation and two heavy seine twine braids which have been weatherproofed. When they are unrolled for an installation these cables are supported on wood-block-type bushings that clamp them firmly and hold them in a safe position.

In general, when the unit is used on 4,000-volt circuits the neutral is carried in and tied to the neutral point of the capacitor. A switching arrangement makes it possible to ground the switch house and trailer frame to the neutral of the 4-kva. system—and this is the usual practice—or to operate with the neutral of the capacitor tied to the system neutral without grounding the switch house and frame.

Ground Relays

For 2,300-volt operation where grounding facilities are of questionable value the frame and house are not grounded, directly, but the ground relays are cut into service. One ground relay is a potential unit of the induction type, with adjustable definite-time-delay circuit closing, and closes its contacts when 50 volts or more are impressed upon it. Its operating coil is connected between the steel house and a ground connection through an "A" auxiliary switch on the oil circuit breaker, so that the relay circuit opens when the breaker opens. The relay closes the trip circuit through a 115-volt trip coil on the main breaker and is fed from the operating transformer.

This relay and "A" auxiliary switch are protected by a by-pass gap connected between the house and ground. This gap is a low-voltage lightning arrester with a spillover value of about 300 volts at 60 cycles.

Under certain conditions a discharge across the by-pass gap may continue to arc provided there is sufficient follow-up current and there might not then be maintained the 50 volts necessary to operate the voltage relay. To protect against this contingency a current relay, rated at about 0.5 to 2.5 amp., is connected to the trip circuit of the main breaker exactly as the potential relay. This current relay is by-passed by a gap just as the potential relay is, but since its impedance is very much lower, even if an arc should occur, sufficient

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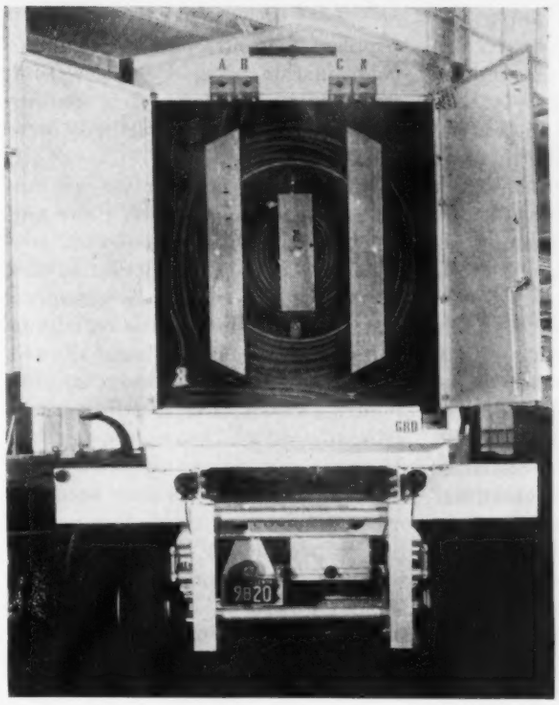


MOBILE capacitor unit for 2,300- and 4,000-volt service

Includes a total of 1,080 kva. of capacitor, switching and control equipment in a weatherproof sheet-steel housing mounted on a two-axle, eight-tired trailer equipped with drawbar, electric brakes and clearance and safety lights prescribed for night travel. Reel in cable compartment at rear of switch house (left) supports 150-ft. cables for connecting to utility's lines and grounding facilities. Phase and neutral conductors are brought out at top; grounding conductor at bottom.

Powerton-Crawford 220-Kv. Line Part II—Design and Construction

New 147-mile transmission link seeks approach to trouble-free operation under all weather conditions—Unusually large conductor clearances, new solutions to inductive and airline co-ordination, construction innovations involving mechanization and modern lightning protection are features

M. S. OLDACRE, F. O. WOLLASTON and E. H. GROSSER, JR., Commonwealth Edison Company, Chicago*

AFTER 10½ months of construction work the first transmission line in the Middle West to operate at 220 kv. was placed in service on September 28, 1940. This 147-mile line was designed and built by Commonwealth Edison Company to bring 150,000 kva. from its Powerton station, near Pekin, Ill., to Crawford station in the city of Chicago.

Because of the importance of this line as a link in the Chicago supply system major emphasis was given to trouble-free operation in its design. Full advantage of advances in the industry in the past decade was taken to prevent outages from abnormal weather conditions. A new analysis of galloping conductors dictated unusually large clearances, and modern lightning protective measures were fully adopted for this line. Special problems of inductive and aviation co-ordination brought out new solutions. Furthermore, several innovations in construction methods were successfully applied.

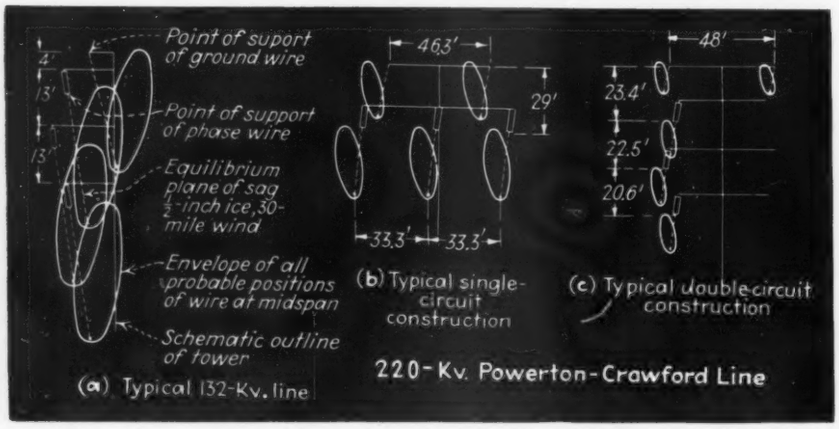
Single-circuit construction was employed for 130 miles from Powerton, in which a 250-ft. right-of-way, adequate for the parallel installation of a future line, was secured by easement. Crowded conditions in the remaining 17-mile section near Chicago allowed only a narrow right-of-way, utilized jointly by four electric utilities, two railroads and a high-pressure gas line. The strip allocated to the 220-kv. line was only 25 ft. wide in some sections, necessitating double-circuit construction to provide for eventual installation of a second line.

The Powerton-Crawford line is probably the first one in the country specifically designed to avoid sleet outages. The large conductors made sleet melting impracticable. Based on Davison's work† and on our own studies of the effect of wire clearances on sleet outage rates for various lines, an empirical rule was developed for establishing adequate wire spacings. The envelope of all possible midspan wire positions for a galloping conductor was taken as an ellipse, with an axial ratio of three, located along the mirror image of the plane of sag of the conductor under the assumed ice and wind conditions. The major axis of the ellipse is a few feet greater than the sag.

Clearances for the 220-kv. line under galloping conditions are shown in (b) and (c) of the accompanying diagram. In contrast the clearances on a typical 132-kv. line, shown in (a), indicate that this line would not operate satisfactorily with sleet on the wires. As a matter of fact, this

* Mr. Oldacre is equipment and research engineer, Mr. Wollaston is supervising research engineer and Mr. Grosser is research engineer.

† "Ice-Coated Electrical Conductors," A. E. Davison, Conference Internationale des Grands Reseaux Electriques A Haute Tension Paper No. 229, Paris, France, 1939.

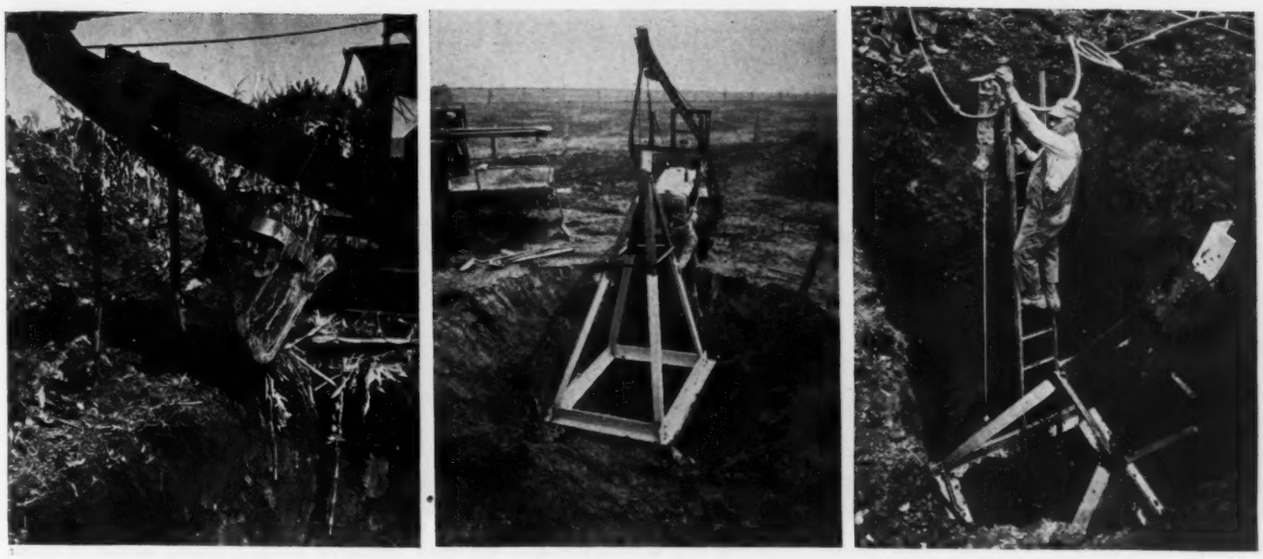


LARGE wire spacings were adopted for Powerton-Crawford line to avoid mid-span contacts. Sleet clearance diagrams show orbits of galloping ice-covered conductors at midspan

Essential Design Data Powerton-Crawford 220-Kv. Line

	Single Circuit	Double Circuit
Miles of line	130	17
Number of towers	637	124
Conductors	900,000-c.m. 54 Al/7 St. ACSR	
Ground wires	Special strength ½-in. Copperweld	
Span lengths—feet		
Ruling span	1,200	800
Average	1,080	700
Maximum	1,275	1,095
Minimum	599	229
Sag and tension data* 60 deg. F., no wind, after 0 deg. F., 8-lb. wind, ½-in. ice:		
Conductors		
Sag in ruling span—ft.	38.6	16.6
Tension—% ultimate	16.7	17.3
Ground Wires		
Sag in ruling span—ft.	26.8	9.2
Tension—% ultimate	15.4	19.5

* Design based on wires attaining 60 to 69 per cent of ultimate strengths at 0 deg. F., 8-lb. wind, 1½-in. ice.



FOOTING EXCAVATION in clay and soapstone soil being dug with gasoline-driven trencher (left). Anchor for single-circuit tangent tower being lowered into excavated hole. Note splice below ground line and asphalt paint coating (center). Air hammer being used to drive 10-ft. galvanized steel ground rod in footing excavation (right)

132-kv. line had many sleet outages until sleet-melting procedures were applied.

Although of conventional outline, the towers for the 220-kv. line are of especially heavy construction. They are designed to withstand an 8-lb. (57-mile-an-hour) wind with all wires intact and carrying 1½ in. of radial ice, as well as broken wire conditions considerably beyond usual requirements.

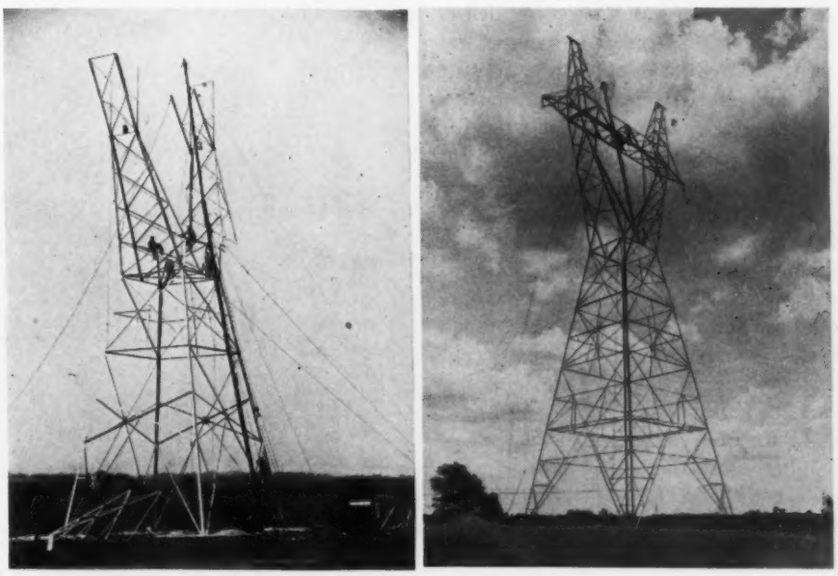
Towers were erected in two ways: (1) Pre-assembled large panels erected with 115-ft. telescopic pipe gin pole on a tractor, and (2) assembly in place, using a slung aluminum-latticed or wood gin pole. In the first method an assembly crew of twelve to fourteen men was followed by two erection crews of about eight groundmen and towermen. The average erection time for single-circuit tangent towers was about 3½ hours per tower per crew, saving one or two hours over the gin pole method. Single-circuit towers with long base extensions and of special types, as well as all double-circuit towers, were erected with slung gin poles by crews of eight men each, averaging about a tower a day.

Tower Footings

Practically all footings consisted of pyramid type earth anchors, designed for the same safety factors as the towers plus 20 to 33 per cent. The installation of a major portion of the footings during winter was a factor in the selection of grillage footings instead of the concrete type. The design included a splice about 3 ft. below the ground line to permit replacement of the upper sections if necessary. Corrosion troubles are believed to be largely forestalled by galvanizing and by two coats of asphaltic paint applied to the upper section of the anchors during installation.

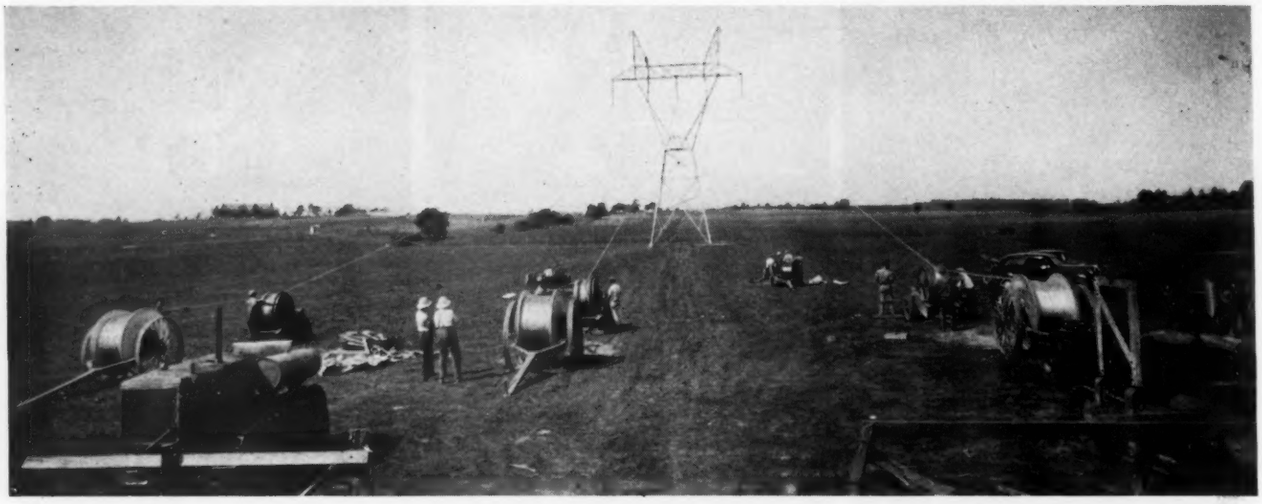
Innovation in footing work was the use of a trenching machine to dig anchor excavations. Another method employed clamshell buckets, and a third, where ground conditions were favorable, made use of both a trencher and a clamshell bucket. In this case two parallel cuts were made with the trencher and the earth in between removed with the clamshell.

All earth anchors were placed on a sand cushion to equalize the bearing, with the result that practically no settling of towers occurred. River gravel was used rather than crushed rock, as it was found to allow the anchors to be moved more easily into line. Although it was originally planned to use the base sections of the towers to set anchors to line and grade, setting by transit proved easier and more satisfactory. This method was used throughout most of the footing work.



TWO METHODS used in tower erection

(a) Erecting pre-assembled tower panels with 115-ft. telescopic gin pole. This method takes about 3½ hours to erect a single-circuit tangent tower, excluding pre-assembly on ground. (b) Floating gin pole that is raised with the tower is here being used to erect this single-circuit tangent tower



MECHANICAL AIDS for stringing under tension. Trailing end of wire-stringing operation employed braking drums ahead of cable reels to control tension in three conductors and two ground wires. Pulling equipment (not shown) used three-drum hoist for conductors and two-drum hoist for ground wires

Backfilling in some cases was done with a bulldozer, followed by an air-driven tamper. In sandy and sand gravel soil anchor holes were pumped full of water and the backfill dumped in, settling firmly into place around the anchor.

A footing crew consisted of a foreman, one or more equipment operators and six workmen. Under reasonably good earth conditions a complete footing, including anchor assembly, could be installed by one crew in a day.

Tower Grounds

Lightning protection measures consistent with a line of this importance demand especially good tower grounds. The protective scheme was based on a maximum tower footing resistance of five ohms. This objective was realized, with an average footing resistance of less than 2 ohms for the entire line.

When footings were installed a 10-ft. galvanized steel rod $\frac{5}{8}$-in. in diameter was driven in each anchor excavation, with air hammers where compressed air was available. Each rod was connected to the adjacent anchor, galvanized steel straps being used to avoid galvanic action. These rods, together with the footing steel, resulted in satisfactory grounds for all except 57 of the 761 towers. Auxiliary grounds—counterpoises and in a few cases ground rods—were installed for these towers.

Short counterpoises, not over 350 ft. long, were used. The $\frac{1}{2}$-in. galvanized steel wire was plowed in, or, in rocky soil, installed by hand labor and buried 18 in. Wires spaced 50 ft. apart were installed parallel to the line on successive tower legs until the desired resistance was attained.

Conductors and Ground Wires

Phase conductors are 900,000 circ. mil ACSR, the largest wire of this type that has ever been installed by

COUNTERPOISE WIRE in excavated trench before backfilling. Note galvanized steel strap used to connect counterpoise to tower

pulling out under tension. Ground wires are special strength $\frac{1}{2}$-in. Copperweld. Hardware selection took into consideration maximum design loads on the wires, and as a consequence resulted in the use of some special heat-treated fittings. New types of compression splices and dead-ends were developed for the ground wires, which embody high strength, light weight and ease of installation. Insulators, of conventional types, were used in single and double strings of 18 or 20 units, the latter applying to standard units for angle towers and high-strength units for dead-ends.

In stringing under tension the three conductors and two ground wires were all installed together. Steel pull lines, attached to the wires with basket-type "come-alongs," were strung over ball-bearing sheaves of the snatch-block type on each tower and pulled out with tractors or three-drum hoists. Aluminum sheaves were used for the conductors and aluminum or steel sheaves for ground wires. To control tension in the wires being installed, a braking drum was used ahead of each cable reel. This was either a single-drum wood-faced niggerhead or a special double-drum snubber.

Where ground and traffic conditions permitted, the simpler method of laying out the wire on the ground from a cart-mounted reel and lifting it up into the stringing sheaves was used.

Five wires were strung, sagged and clamped in at the rate of $\frac{3}{4}$ to 1 mile a day by each of two contractors.

Stringing crews consisted of 50 to 75 men, divided into gangs on wire distribution, pull lines, pulling, sagging and clamping in. Final operations consisted of the installation of armor rods on the phase wires and Stockbridge dampers on all wires.

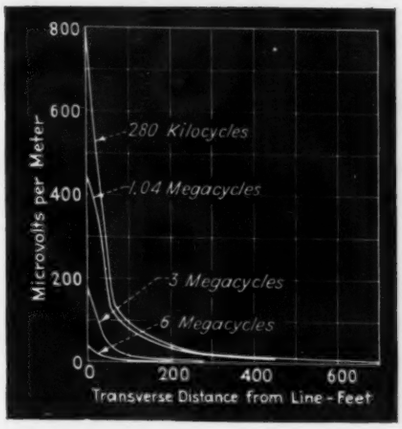
The Completed Line

In the single-circuit section of the line conductors are spaced horizontally, 30 to 33 ft. apart, and ground wires are placed 28 to 38 ft. above the phase wires, depending on span length. Ground wires were installed with less sag than the phase wires. This additional separation at midspan, which applies to the entire line, is intended to give improved sleet clearance and lightning protection.

At the junction of the single- and double-circuit sections a transition is made on dead-end towers. The two ground wires are carried through on the double-circuit section, where only one circuit is now installed. Vertical conductor spacings on double-circuit towers range from 20 to 33 ft. and the two circuit positions are spaced 40 ft. apart, with the middle conductor positions spaced 48 ft.

Spans in the single-circuit section average five per mile and in the double-circuit section 7½ per mile. There are relatively few long spans, the longest being 1,275 ft.

A complex inductive co-ordination problem existed on the double-circuit section of the line near Chicago. Circuits involved included three transcontinental telegraph lines of Postal and Western Union and the phone, wire and signal circuits of two railroads, all closely paralleling the 220-kv. line. Four and a half miles of parallel has only about 200-ft. spacing. Remedial methods included five power line transpositions, in the section where co-ordination was required, calculated to neutralize the effect of currents induced in the ground wires by phase currents. For the communication lines retranspositions and relocations were necessary.



MEASUREMENT of radio noise transverse to Powerton-Crawford line shows a rapid decrease in noise away from the line and lower noise level at the higher frequencies

The most sensitive communication leads located in the parallel were ground-return high-speed multiplex printer circuits. These, in every case, were protected against normal power line induction by neutralizing amplifier equipment. A pilot wire on the signal lead picks up the same voltages as is induced on the signal wires, effecting a cancellation of induction.

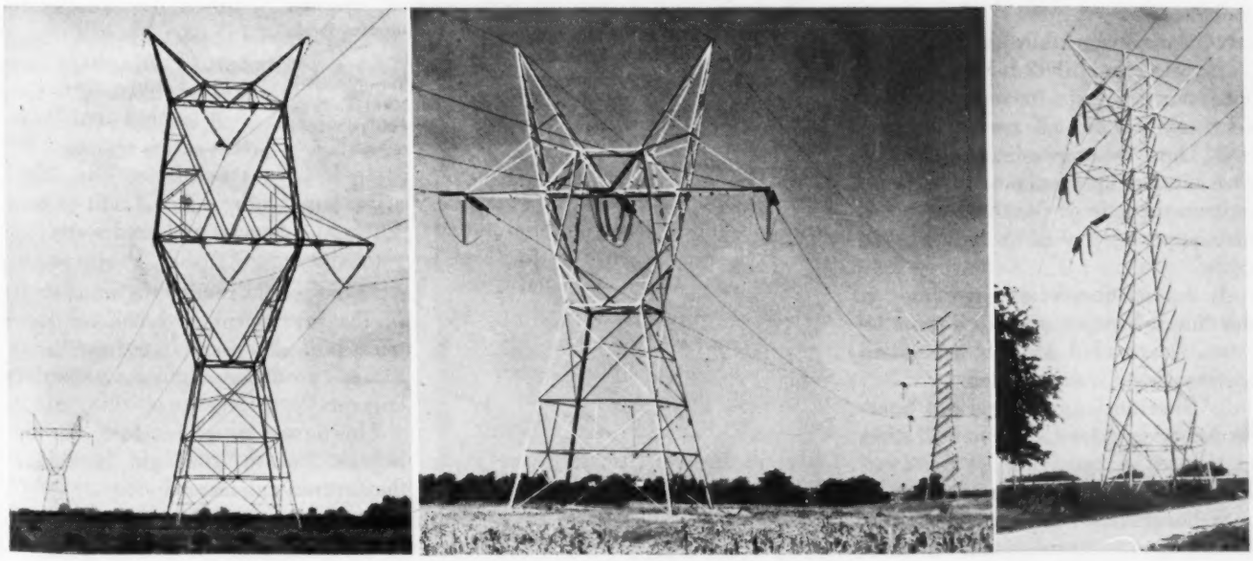
The induction from power line abnormals is substantially above the 150-volt limit of the neutralizing equipment. For this reason arrester relays were installed on the most important signal leads in order to form a short-circuit path to ground for the rather heavy 60-cycle current which would be induced in the rare event of a power line fault.

Two Special Problems

Proximity of the Chicago airport to the north end of the line introduced two special problems—obstruction lighting of towers and prevention of interference with aviation radio services. Towers were lighted by the novel expedient of insulating one ground wire for 10 miles from Crawford station and using it as a 2,160-volt, single-phase, ground-return circuit.‡ Each tower carries a duplex red obstruction fixture containing 120-volt, 150-watt bulbs supplied by a type CSP distribution transformer. Deion gaps are provided for transformer and circuit protection and to permit the insulated ground wire to function normally in conducting lightning strokes to ground.

[*Continued on page 141*]

‡ Complete details of this arrangement are given in a short article in the New Engineering Idea section of this issue of "Electrical World."



COMPLETED TOWERS—A single-circuit transposition is made with two towers like one in foreground. There is no crossing of wires in any span (left). Transition from single-circuit to double-circuit section of line is made on dead-end towers (center). Double-circuit tower used on large angle in line (right)

Voltage Control Extends From Bus to the Outlet

Interior wiring should bear its share of scrutiny along with primaries and secondaries in a program of voltage betterment

FRANK SANFORD* and W. R. WEISE,† Cincinnati Gas & Electric Company

THERE are two lines of approach in designing distribution expansion to meet modern load requirements. Our direct responsibility is with the outside lines, but inside lines must be included in the complete picture of service to lights and appliances. We must keep on adding outside equipment, but if we give to the inside part of the complete distribution system the same concentration of effort that we have the outside, we can eventually combine the two in a workable solution.

Several definite steps are being tried here and more must be found:

1. A standard for transformer-secondary impedance is in use by the complaint and rearrangement inspectors. Complaints can lead to wiring recommendations as well as to outside rearrangements, if the outside conditions are within this standard.

2. Our regulations for electric service carry a requirement for three-wire services for all new residences.

3. Our recommendations include provision of an appliance branch circuit on the side of the three-wire service opposite the main lighting circuits.

4. Service inspections are made at the time of major appliance installations. Overloaded services are called to the customers' attention.

5. Distribution engineering interest has been extended to co-operation in the wiring program of the local commercial groups. Demonstrations and discussions before these groups have helped the educational effort of the wiring program.

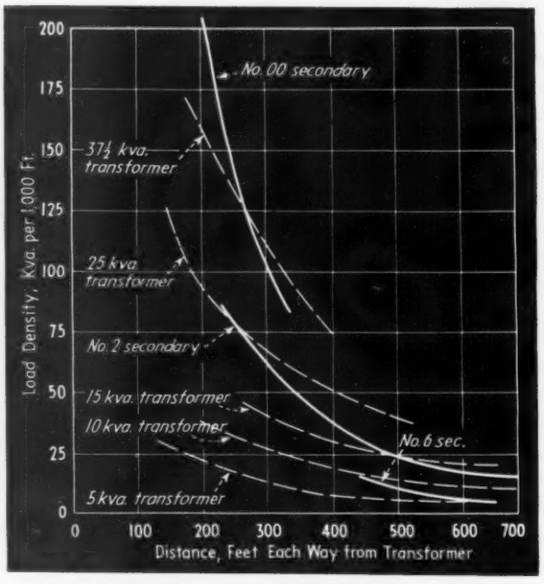


FIG. 1—NUMBER 2 wire has wide-range of economic applicability for average lighting and appliance loads in suburban residential areas

The most economical system is based on uniformly distributed load with two-way feed and 2½ per cent voltage regulation. Transformers loaded on peak to 160 per cent before change.

6. Co-operation with the Fire Prevention authorities in eliminating strapped and over-size fuses is also a factor in bringing the overload conditions to customers' attention.

Two familiar facts regarding modern electric distribution systems with respect to the voltage control problem are:

1. Wire sizes, transformer sizes and locations, and system arrangement and facilities have in general kept pace with load increases coming from increased use of appliances and improvement of lighting.

2. Regulators are used that can compensate for the voltage drop of primaries, transformers and secondaries to some average point of service to customers' wiring.

Two additional facts are also generally recognized, but they are not commonly associated with each other and with the first two mentioned:

1. Inside wiring facilities have not been planned or increased in proportion to the increased use of appliances.

2. Lamp flicker caused by motor-starting currents is a major part of the voltage control problem.

A recent article in this series reviewed the possibilities for "Distribution Outlays to Limit Lamp Flicker."‡ A very pertinent statement was:

"Few people realize the magnitude of the investment in secondary systems to make them free from lamp flicker produced by motor-starting currents."

This is an important fact, but we believe that to it should be added the further statement that:

While there is general realization of the inadequacy of present building wiring for modern loads, it is not

* Distribution engineer. † Electrical distribution department.

‡ By D. K. Blake, "Electrical World," September 2, 1940.

generally realized how much this factor adds to the lamp flicker problem.

Distribution engineering is concerned with the problem of providing adequate facilities to carry the loads and deliver satisfactory service to the customers' meters. Voltage control is one of the two principal measures of satisfactory service. As the load has increased, the characteristics have changed, and distribution changes to limit lamp flicker have become a definite part of voltage control. To meet the problem we have available several possibilities:

1. Redesign of transformer-secondary combinations to reduce impedance.

2. Banking of secondaries through fuses, to divide the current flow between two impedances.

3. Use of auto-transformers at the secondary ends, to divide the current flow over two paths.

Studies to determine the most economical secondary system for given conditions show (Fig. 1) the wide economic range of No. 2 wire for average lighting and appliance loads in suburban residential areas. Similar studies by others show the same size, or the size under or over, No. 2 wire for load densities between about 15 and 85 kva. per 1,000 ft.

Voltage Regulators

Transformer voltage drop does not need to be included in the 2½ per cent regulation because transformer loading coincides with feeder loading and can, therefore, be included in regulator compensation. Regardless of peak permitted, whether 125 per cent or 160 per cent, compensation can be included with the drop allowed for primary line and secondary. An average and uniform high degree of peak loading is a part of distribution economy and it is possible with periodic load tests. These two factors are often overlooked or neglected in secondary studies.

Voltage regulators with line drop compensation are essential to full use of distribution investment. They extend the range of feeder operation for acceptable voltage. They cannot, however, compensate for instantaneous load and voltage changes caused by motor starting. Appliance motor-starting currents must therefore be the design basis for secondary system layout.

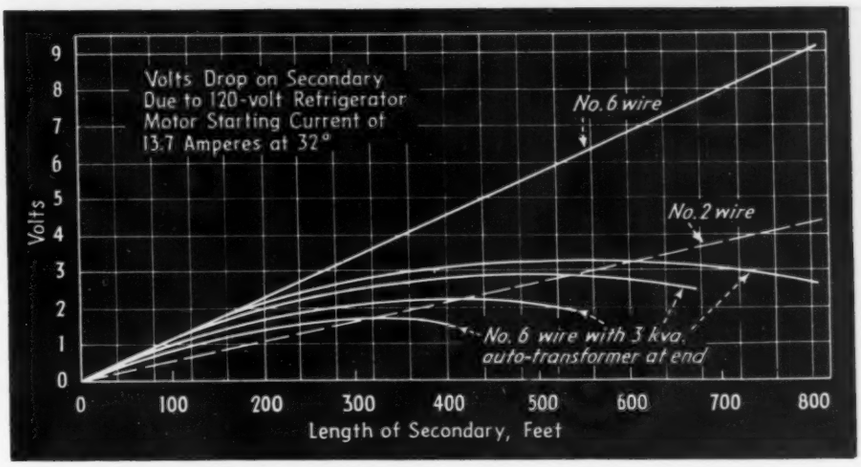


FIG. 2—VOLTAGE CONDITIONS prove better with No. 2 wire than with No. 6 wire and auto-transformers

A further or alternative investment that is sometimes made on distribution secondaries is the use of auto-transformers. Fig. 2 compares the voltage improvement obtained with (a) No. 2 wire, and (b) No. 6 wire and auto-transformers. There are often local situations, or specific cases, where addition of these devices is the best method for correcting an unsatisfactory voltage condition. As a standard layout, however, they are usually not desirable from an economic standpoint.

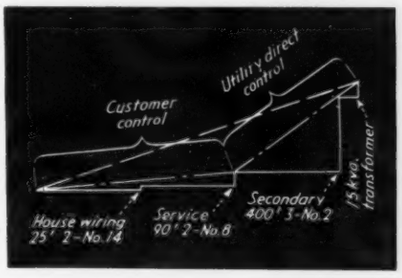


FIG. 3—IMPEDANCES in typical service to appliance outlet show more responsibility on customer than on utility

The average service, service entrance and branch circuit to outlet have combined impedance about equal to that of a 15-kva. transformer and 400 ft. of No. 2 secondary. Only 25 ft. of No. 14 house wiring is equal in impedance to 300 ft. of No. 2 secondary.

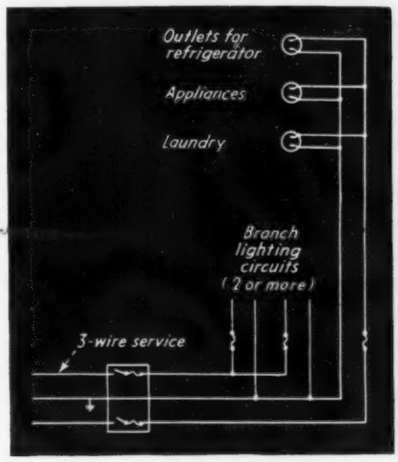


FIG. 4—SEPARATE branch circuit for refrigerator and appliances connected to one side of three-wire service to eliminate lamp flicker

Inside Distribution

Building wiring is concerned primarily with placing outlets where they are wanted for lights and appliances. In the early days of residential wiring, the standard service, which was adequate for the load, consisted of two wires to the meter, with two branch circuits of No. 14 wire. Millions of homes were wired with one branch circuit for upstairs and one for downstairs.

After universal acceptance of electric service for lighting, we entered the next phase of electrical development with promotion of washing machines and refrigerators, and later heavy irons, blowers, stokers and roasters. But the wiring promotion was over, and these new appliances were connected to the nearest outlet, or, at the best, a new outlet was connected to the nearest point in the wiring.

Wiring inadequacy is widely recognized and a national promotion program includes "Check Your Wiring" literature. The primary objective is to outline and promote adequate wiring in new homes. In areas where electric cooking is an active part of the commercial growth this problem of service and wiring is, at least in part, being approached. But adequacy

on this basis alone has reached something less than 12 or 15 per cent on a national basis.

Millions of lights still flicker with starting of refrigerator and furnace blower and stoker. And the "Better Light—Better Sight" promotion is gradually raising the expectancy, with the result that light flicker complaints are still a major source of distribution rearrangement plans.

Must Combine the Two Parts

We usually measure voltage at the entrance switch, but it may be quite different at the lamp socket, where the customer measures it in his observation. Thus, whether or not we consider inside wiring as part of our total distribution problem, it is important in our efforts to render satisfactory service. The economic solution is not entirely one of adding more investment outside, and additional inside wiring can be reconciled with minimum net cost of service.

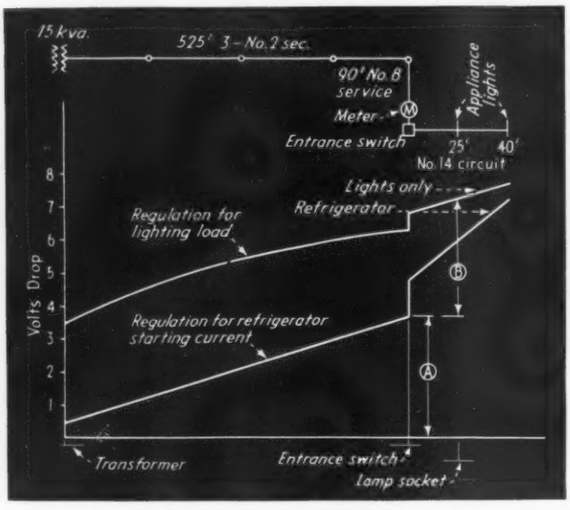


FIG. 5—VOLTAGE REGULATION for lighting and appliance loads. The uncompensated portion of the lighting load regulation (B), about 3 per cent, is comparable to A, the 3 per cent dip caused by a refrigerator on a three-wire service

If the appliance starting currents are drawn through a separate branch circuit in the house wiring this portion of voltage drop does not affect the lighting. If the separate circuit is carried back through the service and the service entrance (Fig. 4), this large portion of drop is entirely eliminated from the light flicker. This type installation is largely the customer's responsibility, and is essential to prevent flicker caused by appliances in the same wiring system.

With a two-wire service the separate appliance branch circuit can reduce the inside drop from 3.6 volts to 1.2 volts. For the conditions shown in Fig. 5, the three-wire service and separate appliance circuit reduce the total fluctuation drop, from primary to lighting outlet, from 7.2 volts to 3.6 volts. This diagram also shows a comparison of the drop caused by normal lighting load and the sudden drop caused by a refrigerator starting.

When secondaries are designed for flicker a reasonable maximum impedance value should be specified at the service-entrance switch. This should then be obtained in the way most nearly in accord with the economic transformer-secondary design requirements. Beyond this, elimination of flicker should involve house wiring and service entrances.

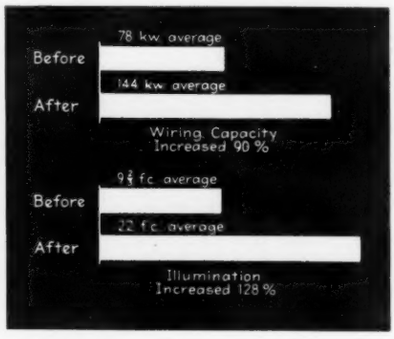
Along with the voltage improvement, the customer reduces fuse troubles, has capacity available for further appliance loads and has taken an important step toward an adequate wiring installation. Appliances in use now definitely indicate the need for further wiring, both for satisfaction and from the standpoint of safety. The three-wire service with good neutral grounding is a part of modernized wiring in older residences and is especially important on long services, and for long circuits in multiple apartment buildings.

When load densities below 10 kw. per 1,000 ft. exist in partially developed areas, and No. 6 wire is retained, the service-entrance impedance must not exceed 0.3 ohm to avoid flicker complaints. This limits the layouts to 5-kva. transformers and only two spans of No. 6 secondary instead of four spans, as dictated by the normal lighting load curve of Fig. 1. The three-wire service permits the use of three or four spans of No. 6 without exceeding the voltage limits of 0.3-ohm service impedance, because the last spans in each direction can be balanced with the lights against the appliance circuits.

Thin Wall

THE NEW thin wall wire insulations are proving in actual practice that their use increases customer utilization capacity and results immediately in much higher lighting values.

In a preliminary study by the Edison Electric Institute wiring committee of some installations made prior to the effective date of the new 1941 National Electrical Code it appears from 24 jobs with comparative data that the average improvement in kilowatts of utilization capacity is 90 per cent.



THIN wall insulation results in increased wiring capacity and in improvement of illumination

The increase in lighting levels based on eighteen jobs in the same survey is 128 per cent average. Every job showed an improvement.

The survey included reports on 51 jobs, but only 29 of them had any data other than location. These figures are shown below.

One of the interesting bits of information that developed from this survey is that it took on the average but 138 ft. of conductor per each added kilowatt of utilization capacity.

Generally speaking, the installations reported use Nos. 12 and 10 for branch circuit wiring, although a few went to No. 8 and two to No. 6. That would be expected because with but a few exceptions these were commer-

Insulation Rewiring Survey

Limited and fragmentary data, mostly on small jobs in commercial buildings, reveal the utilization capacity nearly doubled and lighting intensity up 128 per cent on average

cial type buildings. Of the total, twelve reported the use of bare neutral.

The data show that in two-thirds of the cases less than the maximum permissible conduit fill is employed.

These data are by no means conclusive. Besides being fragmentary and small in number, they cover in the most part small jobs. More significant data will be available when more big rewiring jobs come along.

Nevertheless, limited as the data are, they do give positive evidence that thin wall conductors make rewiring possible and that the increases in utilization capacity and use are substantial.

Data on Installations of Thin Wall Insulated Conductors

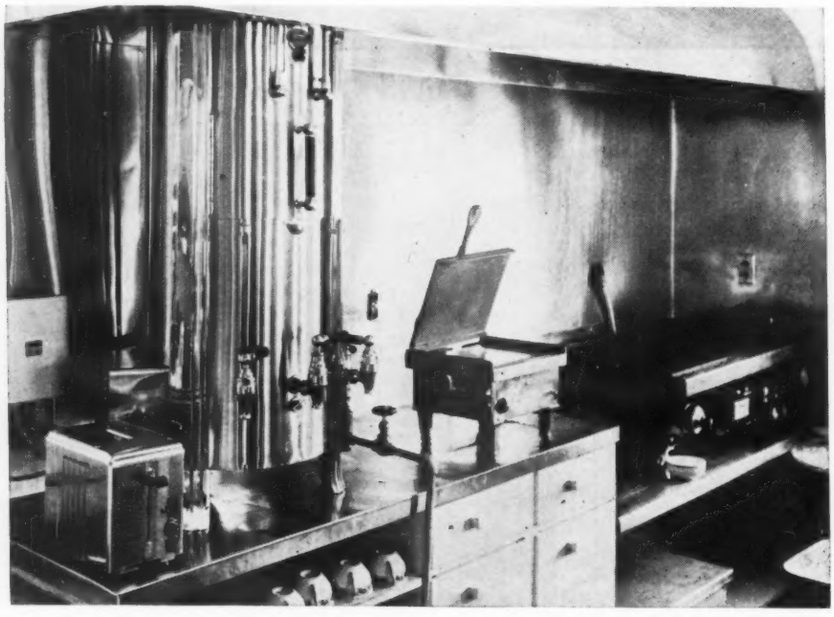
Description of Building Rewired			Details of Installation											Improvement Achieved			
			Extent of Rewiring		Feeder Sizes		Branch Circuit Sizes		Bare Neutral Used		Insulation Type	Conduit Fill	Thin Wall Wire, Ft.	Utilization Capacity, Kw.		In Lighting Levels, F. C.	
Stories	Total Floor Area Sq.Ft.	Type of Building	No. of Floors Rewired	Floor Area Rewired Sq. Ft.	Old	New	Old	New	Yes	No				Old	New	Old	New
3	200,000	Office	4	200,000	6 No. 2	3 No. 4/0	No. 14	No. 8	X		RU	50%	.....	120	300	20	40
1	30,000	Laboratory	1	30,000	2 No. 6	No. 4/0	2 No. 14	2 No. 6	X		RU	40%	.....	2	40	10	50
4	49,500	Garage & misc.	1¼	15,000	4 No. 2/0	3 No. 4/0 & 1 3/OB	Nos. 12, 10	Nos. 8 & 10	X		RU	45%	.....	128	162	20	45
4	26,900	Office	4	26,900	3 No. 2	3 No. 2/0 & 1 2/OB	No. 14	Nos. 10 & 8	X		R	.....	.....	34	173	4½	40
7	72,400	Store	7	70,000	3–500 MCM 1–4/OB	3–500 MCM 1–4/OB*	.....	No .12	X		R	.....	.....	42	157	.....	.....
2	.....	Garage & display	1	3,600	.....	2 No. 4 1 No. 6B	.....	.....	X		SN	.....	1,000	2.4	10.5	.....	.....
...	.....	Office	.....	.....	.....	.....	.....	No. 10	....		RU	.....	.....	.....	.....	.....	.....
15	82,500	Office	6	33,000	.....	.....	No. 14	No. 10	....		RU	.....	29,500	.....	.....	.....	.....
2	12,000	Office	Part of 1	1,000	No. 6	No. 1 & B	No. 14	No. 12	X		SN	.....	2,500	3	8	15	40
...	.....	Store	1	.....	.....	.....	.....	.....	.....		SN	.....	3,000	11.25	39	.....	.....
2	.....	School	2	.....	3 No. 4	2 No. 1/O & B	No. 14	No. 12	X		.....	50% Max.	4,000	24	48	1	18
12	.....	Office	1	.....	3 No. 4	2 No. 2, 1 No. 4B	No. 14	No. 10	X		R	.....	1,000	7	14	15	20
11	60,000	Office	1	5,500	No. 4/0	No. 4/0	No. 12	No. 12		X	R	.....	3,000	8	32	5	10
3	24,000	Office	Part of 1	1,800	.....	.....	3 No. 12	6 No. 12		X	SN	30%	1,000	8	12	12	35
22	147,600	Office	9	64,000	.....	.....	No. 14	No. 12		X	SN	25%	81,000	650	830	8	24
12	48,840	Office	10	40,000	.....	.....	No. 14	No. 10		X	RU	37%	20,000	25	100	5	25
1	.....	Office	½	3,000	3 No. 10	3 No. 2	No. 12	No. 10 & No. 12		X	RU	34%	1,500	5	20	5	20
...	.....	Athletic field	.....	.....	.....	.....	No. 12	No. 12		X	RU	.....	13,000	.....	.....	.....	.....
6	69,000	Office	1	9,000	6–200 MCM	8 No. 4/0	No. 12	No. 10		X	RU	40–50%	17,500	96	162	.....	.....
10	15,625	Office	.....	.....	3 No. 2	6 No. 2	.....	.....		X	RU	45%	5,500	600	1,200	.....	.....
4	13,000	Office	4	13,000	No. 2	No. 2/0	Nos. 14, 12	Nos. 12, 10		X	RU	50–60%	4,500	30	70	15	75
1	3,200	Manufacturing	1	3,200	.....	.....	.....	.....	X		.....	.....	1,500	4	12	.....	.....
...	.....	School	Part of 1	.....	.....	.....	2 No. 14	2 No. 10, 1 No. 8B	X		.....	.....	.....	.....	.....	.....	.....
...	.....	School	Part	.....	.....	.....	2 No. 14	6 No. 10		X	RU	.....	.....	.....	.....	.....	.....
1	27,000	Office & mfg.	Part	6,700	.....	.....	2 No. 14	2 No. 12		X	SN	.....	2,000	1.8	5.5	8	22
3	6,750	Utility office	Part	1,350	.....	.....	No. 14	2 No. 12		X	RU	.....	240	1.5	5.25	10	50
3	12,300	School	3	12,000	.....	.....	.....	.....	X		.....	.....	3,000	7.5	30.6	7	18
2	3,125	Manufacturing	Part of 1	.....	.....	.....	4 No. 14	4 No. 10 1 No. 6		X	.....	.....	1,500	4.4	11.0	4	14
3	30,000	Manufacturing	.....	4,600	.....	.....	2 No. 14	2 No. 12		X	.....	.....	1,500	6.0	10.0	10	25

* New feeder paralleled with old one. B Bare.

Electric Cooking Builds a Business

Selling and servicing by Consumers Power combined with customer advertising spells typical success story for the customer and new sources of commercial revenue for the utility

FRANK A. RICHARDS, Consumers Power Company, Grand Rapids, Mich.*



SHORTLY after an electric counter cooking demonstration at the local office of Consumers Power, two Battle Creek men opened their first restaurant with this equipment. The new shop also required modern interior lighting, electric coffee makers, mixers and exterior neon and flood lighting

IF COMMERCIAL electric service is to continue the rapid growth of the past five or six years, running neck and neck with residential sales, utility companies must continue to sell the commercial service on the basis of customer profits from the use of the service.

How and how much our customers profit from the use of electric counter cooking equipment depends a great deal on how well we judge the customers' needs so far as the type of equipment to be used is concerned and how well we sell the customers on the various uses of the equipment after it has been purchased. Our customers cannot help but profit from the distinct advantages electric cooking gives them, such as cleanliness, better cooked food, comfortable atmosphere, speedy service, savings on food cost, as well as advertising.

Advertising Pays

We have always contended to our customers that due to the tremendous publicity given to the superiority of electric domestic cookery a large percentage of the public would patronize a restaurant or lunchroom that used electricity for cooking if they knew it. Several of our customers capitalized on this idea. They advertised that in order to serve their patrons better-cooked, quality food, to give them a cleaner and more comfortable atmosphere, as well as quicker service, they were using electricity. This advertising was done through the newspapers and menus as well as by mentioning that they used electricity whenever a patron commented on the good food, fast service or comfortable atmosphere.

One of our customers had the following printed on the bottom of his menu:

> Our food is refrigerated and cooked electrically. Food cooked electrically is more healthful because it retains the natural minerals and vitamins. Bring your friends when you come again so they may enjoy our delicious food.

Another, who is in the drug business, uses the following in his newspaper ads:

> When you visit the beautiful fountain restaurant in our store, note particularly the modern, all-electric kitchen. The kitchen is the last word in cleanliness, convenience and efficiency. Patrons of our fountain will note the difference in finer cooked, more tasty foods as well as being assured of absolute cleanliness.

Case History

A perfect example of a food service operator who has profited exceedingly well from the publicity angle of using electric counter cooking is Ritzee Hamburgs, Inc., Battle Creek, Mich.

The two owners attended one of our electric counter cooking equipment demonstrations at our Battle Creek office in the spring of 1937. They were greatly impressed with the

* Adapted from first-prize-winning paper in National Contest of Electric Cooking Council.

equipment as well as with several ideas we gave them about operation. Shortly after Ritzee Hamburg No. 1 was built and opened, and proved a great success.

They have continuously served the best quality food obtainable. In their publicity they never omit mentioning that they use electricity for cooking, and give credit to electric cooking for 50 per cent of their success in business.

Second Unit

Less than a year after opening Ritzee Hamburg No. 1 they built and opened Ritzee Hamburg No. 2. Because it is located across the street from the Battle Creek high school they put in a complete electric kitchen as well as the electric counter cooking equipment so that plate lunches could be served to the school children at noon. This shop has also proved a success.

The following is a letter we received from one of the owners regarding electric cooking in the two shops:

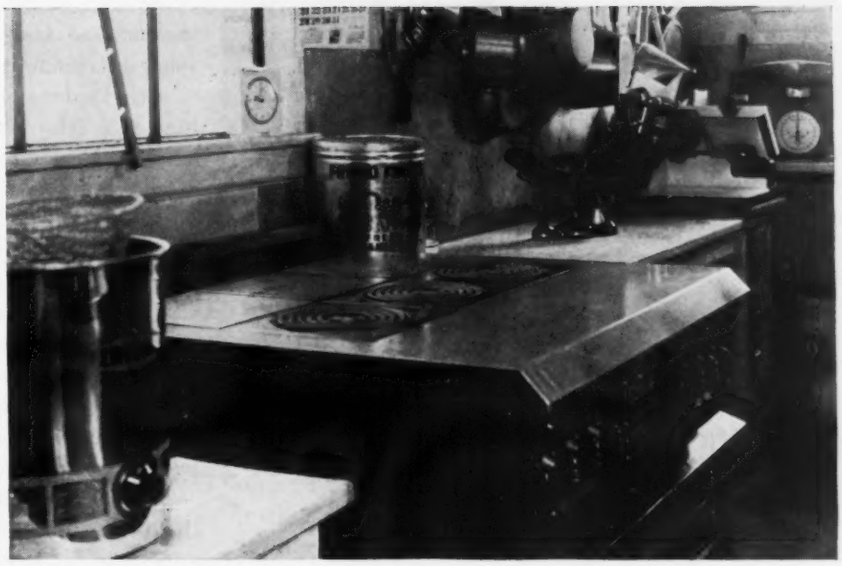
> I have always been a great booster for electric cookery at home, but in a commercial way, it being new, I wanted to wait until I was sure that it was economical, fast and workable before I convicted myself.
>
> To date we have proved it to be very economical, clean, fast and sure, giving us a superior finished hamburg, in that it is more juicy, tender and richer in true meat flavor.
>
> Our heavy-duty Edison General Electric range is the last word in kitchen equipment, roasting meat to the most beautiful brown and yet cooking through and through with less shrinkage. For cooking we have found this range to be really fast and easy to operate. I want you to know that we are also happy with our McGraw Electric coffee urns, which we have in both Ritzees.
>
> In conclusion, this is the way I feel about commercial electric cooking: "The way you succeed depends on how you cook. Do it electrically and be a success."

Bakery Goes Electric

In the fall of 1939 the increase in the demand for electrically grilled, baked and roasted foods for home consumption was so apparent that they decided to include an electric kitchen and an electric delicatessen counter in their new retail bakery on Battle Creek's main street. This turned out to be a successful addition to the bakery business, and on March 24, 1939, they wrote me the following letter:

> I thought you might be interested in what I think of electricity in cooking and also some of the results we have experi-

[*Continued on page 143*]



SECOND SHOP, opened a year later, was located across from Battle Creek high school. It included a complete electric kitchen with heavy-duty equipment and electric counter cooking

ANOTHER YEAR passed and the owners added an electric kitchen and electric delicatessen counter in their new retail bakery. Last year the third shop—also all-electric—was started

THIS YEAR the fourth unit was opened with counter equipment, heavy-duty equipment, tubular lighting, air conditioning and exterior display lighting providing customer service and utility revenue

Editorials

S. B. WILLIAMS, *Editor*

Legal Determination of Utility Act Indicated

HOW CAN a holding company comply with the integration provisions of the Public Utility Act? When William A. Douglas, now associate Supreme Court justice, was chairman of SEC the commission asked the companies to submit plans with the understanding that hearings would be held promptly and a decision given. Some companies did prepare elaborate reports and some hearings have been held. Other companies, feeling that before plans could be prepared they would have to have the commission's views on compliance, asked SEC to supply them with a blueprint. The first to come out, that for U.G.I., provides a most unattractive picture for holding companies with far-flung systems.

While the SEC order for reconvening U.G.I. hearings this week states that its opinion on integration is tentative, it clearly indicates that when pressed to take a position it would hold to the most stringent interpretation of the law. In this case the company is allowed but a single closely knit system in three adjoining states, with Philadelphia as the center.

Is this to be a pattern for the other holding companies?

Obviously, the companies will ask for a much broader interpretation, especially companies that may have more than one integrated system under their control. With such a wide divergence of opinion it begins to look as though the courts in the end will have to determine the meaning of the act.

It was hoped and for some time it looked as though differences of opinion could be adjusted around the conference table. Such a course would provide compliance much sooner than the courts and would the more quickly release management for the National Defense tasks that Chairman Frank stresses.

It is to be regretted that SEC was put in a position where it had no other recourse than to take such a narrow position, for obviously in so doing it makes compromise on a reasonable basis more difficult.

On the other hand, if the SEC has purposely allowed itself to be jockeyed into a position where it had to take this narrow stand in order to secure a Supreme Court interpretation of the provisions of the act, then the commission is to be severely criticised for the delay. In the famous Electric Bond & Share case the government fought the holding company's request for a full interpretation of the act and insisted that the case be narrowed down solely to a finding on the registration provision.

Had a decision on the entire act been rendered at that time this delay would have been avoided and management could now be giving its full attention to power for defense.

Of course, at that time the sympathies of the Supreme Court for New Deal legislation were not as positive as they are today.

On the other hand, most of the New Deal appointees to the Supreme Court have at one time or other been definitely associated with this act in one capacity or another and by precedent may find it judicious to dissociate themselves from any interpretation. The number includes Justices Black, Douglas and Reed.

The act itself is an excellent example of what happens when legislation is drawn in a spell of ill temper. It remains to be seen if even this Supreme Court can find precedent or reason for requiring a holding company to buy or sell properties, at least within the narrow confines of the SEC interpretation as laid down in the tentative U.G.I. opinion.

A Program for Free Enterprise

EVER SINCE the fall of 1929 the American way of free enterprise has been questioned. More and more has business fallen under the domination of, and in some instances ownership by, government until now the very essence of Americanism, free enterprise, is challenged.

For a while business men were content to say "They can't do these things to us in this country." But they did. And all the while government continues to offer new regulations in the hope that by curing abuses the general economy of the country will be improved.

What is business doing about it? Is it helping government or Congress to arrive at any better solutions than those now proposed? Has it any program to prevent a business shambles after this emergency is over, or is it willing to let government take over the cushioning through continued spending?

A program of this nature was presented at last week's midwinter meeting of the A.I.E.E. by G.E.'s president, C. E. Wilson. The program of four parts is timed to definite production index levels and involves considerable economic and social control.

The timing may be off and there may have to be considerable modification of the program to make it work; nevertheless, it is a realistic approach to the situation that is challenging American business. The job to be done cannot be unilateral. It must involve understanding co-operation between business and government.

It took courage for the head of a large manufacturing company alone to stick his neck out as far as Mr. Wilson did with his suggestions. Nevertheless, the very sincerity and coverage, and even definiteness, should accord to them consideration and discussion.

We are in the midst of hurried National Defense production because we were not prepared. Let's not get into a similar state of unpreparedness after this emergency is over.

How Long Can Prices Be Held Down?

THE LAW of supply and demand which ruled supreme during the previous World War has been interned for the duration for being unpatriotic. It makes no difference how large or immediate the demand or how short the supply, prices are to be kept down. In other words, we now have for the first time in this country a seller's market with the buyer holding the whip.

For regulated business like utilities this policy of the Administration is going to prove very attractive. It would have been very easy under any other policy for the new expanding utility investment to have cost considerably more, thereby increasing fixed charges, to say nothing about fuel and other operating costs.

How long this situation can continue, with rising labor rates, is something else. Of course, double and triple shifts in industrial plants considerably offset higher wages by spreading fixed overhead. This cannot go on very long, however, without being reflected in prices.

In the meantime, however, the lid is on with respect to prices of both raw materials and finished products and effort will be made in Washington to keep it on just as long as possible, even if it means taking over certain industries.

Early Graduation of Engineering Classes

THE SUGGESTION is made by A.S.M.E. President Hanley that 1942 engineering classes be graduated at midyear and that to accomplish this the engineering schools continue in session through the summer. Industry at the moment, under the stress of defense production, needs engineering graduates faster than they are being turned out.

While there is considerable obvious merit in the suggestion, particularly since the Naval Academy is showing the way this year, the decision is one for the students to make, rather than the colleges or industry. These students cannot be drafted until after graduation, and much as they are eager to start working, many will realize that earlier graduation merely advances draft time.

If it is essential to industry that these young engineers be available earlier than usual, then perhaps the colleges could co-operate by releasing graduating classes in late April, which is the time when most of the work as a rule is completed. After all, final examinations are not so very important and theses can be submitted later.

Daylight Tubes Yield to White

TIME AFTER TIME artificial daylight units are brought forward as the answer to good lighting, but one by one they fail to get wide public acceptance. The latest is the daylight fluorescent lamp. The first year it was on the market its sales were 60 per cent of the total tube output and more than twice those of the white lamp. A year later, in 1940, daylight was down to 43 per cent of the total and white was in the lead with 52 per cent.

It is true that even at the lower figure of 43 per cent more daylight tubes were sold than in the previous year. Nevertheless, the public has shown unmistakably that for general illumination it wants the warmer light of the white tube. There is nothing friendly about the light from daylighting units, nor do the people who work under it look friendly.

Furthermore, while daylight units cannot be equaled for critical color matching, they distort the color of many things, particularly foods, from values that human beings have come to know.

Other experiments by lighting engineers, particularly in the field of fixture design, have demonstrated that the public is not interested in just good light. Human psychology is such that people like their pills to have a sugar coating.

A.I.E.E. Sponsored Defense Broadcasts

THE American Institute of Electrical Engineers is to be congratulated for sponsoring a weekly broadcast on the use of electricity in National Defense. Electricity in its application has become so closely associated with the day's operations that it has become commonplace. To the public it no longer has the romance it had at the turn of the century.

Telephone, telegraph, radio, light, power, control have become essential elements of commerce, of production, of home making. Without them the defense program would barely crawl where it now runs.

Almost without exception this great development has been made by the initiative of private capital. Government has added little but restrictions.

And yet electricity in all of its forms is prepared to meet whatever demands this emergency may make on it. Few other industries can make as good a showing. Its resources are pledged to speeding up defense. Its research will protect our fighting equipment and add new tools of defense and offense. Its man-power will implement the engineering and communication forces of the Army and Navy.

Men of the far-flung electrical industry can be proud of the contribution of their work to National Defense. It is a fine thing that this story can go to the American public under the auspices of A.I.E.E., an organization with no commercial affiliations.

The Go-Between

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

THERE is a fly in the sweet federal hydro syrup. It was put there by Harold L. (Honest Harold) Ickes. In brief, Mr. Ickes does not like the TVA pattern for future government hydro set-ups. He prefers administrators. It does not sound important, but Ickes' idea of an administrator is a super clerk in Ickes' department who will take orders from Ickes and nobody else.

The notion of three-man boards being responsible to nobody but the President, as Ickes sees it, simply flies in the face of the Roosevelt government reorganization policy, which is to put everything and everybody on a neat chart with the President "protected" from the annoyance of details by some responsible intermediary.

And who is a better intermediary, thinks Ickes, especially on power matters, than Harold L. Ickes? Besides, perish the thought, another Arthur E. Morgan might creep into the picture if these three-man boards, a la TVA, are continued.

No Crumb of Comfort

It should be explained at this point that this fly in the federal hydro syrup is nothing for the horse-and-buggy lads, who think private initiative is better than government operation, to get cheered up about. The old saying that when thieves fall out honest men will get their dues, or in this case that when the public ownership boys get to scrapping the private operators might get a better deal, is strictly not applicable.

The fly will be swallowed, shortly, and will probably not even produce indigestion. If Ickes swallows the fly, it will not be the first rebuff he has endured at the hands of his beloved President. He will smile in public as happily as though he had just been made a present of some rare stamps, and go right on working for the cause. On the other hand, if "Papa," as the President likes to call himself when explaining to newspaper men that the final word on everything must always be his, should decide that Harold shall have his "administrators," the worst that will happen will be some dirty cracks on Capitol Hill at Harold for trying to stick his nose into everything. The "Power Bloc" can take it from "Papa," as sweetly as Harold does, except for a bit of critical oratory before swinging into line.

They Helped Him

Unwittingly, the opponents of government ownership gave Harold a leg up in this fight. Remember when they scared Congress—at that time pretty subservient to the White House—into pigeon-holing the old "Seven TVAs"? The notion then was to have every important river where there was any chance for power modeled into a sort of TVA barony.

But that died, and now there is no talk of reviving it. But under another name most of the ideas are being revamped. Already on the program of the public power group are:

1. The Cumberland.
2. The Arkansas.
3. The Columbia.
4. The Central Valley.

It appears today that they will get their stage cues in about that order. As to the first, there is no controversy. The plan of all the public power boys seems to be to hand that domain over to TVA. There are a lot of dam sites on the Cumberland, and in about a year, when TVA will have an organization without sufficient functions to keep it going, after the Cherokee Dam is out of the woods, these would be very timely.

The Arkansas project so far is progressing toward a TVA set-up, despite envious glances from Ickes. It involves the Arkansas, St. Francis, Red and White rivers and their tributaries, involves seven states and an area estimated at seven times that of TVA, and promises a bitter interstate battle. Governor Carr of Colorado has denounced it already. And Colorado is no slouch at fighting for her rights on water power, as those who remember the Colorado River controversy will testify.

Where the Trouble Brews

It's when we come to the Columbia that the fight is imminent—and hot. Ickes has his bill in, as he did last session. He wants to run that affair himself, with his own type of administration, which will be absolutely under his thumb. He is particularly interested in controlling the purchase—if and when—of electric properties now in private hands. He doesn't want any three-man TVA type of board handling those negotiations. Incidentally, this "administrator" would be authorized to float $200,000,000 of bonds ostensibly to purchase the private properties and for other purposes.

"Papa" Sitting Back

Those members of the power bloc on Capitol Hill not too much beholden to Mr. Ickes would prefer to see an "authority," on the TVA pattern, govern this great area. There is a great deal of talk about what is going to be done about it. "Papa" has not been heard from.

The Central Valley project is not imminent. No power is expected before 1943 or 1944.

Meanwhile other public power advocates in Washington are busying themselves designing a national defense mantle with which to drape these various "authorities" and "administrators."

NEWS OF THE WEEK

Associated Gas Trustees Move to Revamp System

Hold conference with Governor Maybank for sale of South Carolina facilities — Utility Management Corp. to be placed on "request basis" to perform services for subsidiaries

Trustees of the Associated Gas & Electric System are moving forward with their plans for the disintegration of the vast utility empire built by Howard C. Hopson and now in receivership.

Following the recent shifting of operating executives, Alex Speer, vice-president of Utility Management Corp., has sent a letter to all operating properties proposing that in the future all services rendered to the system's properties would be performed only on a "request basis." It is also proposed to change the name of the service organization to the Atlantic Utility Service Corp. and that subsidiaries which have invested capital in the service organization be entitled to earn a return on this investment.

To Sell Properties

In another move to decentralize and disintegrate the system conferences are being held with Gov. Burnet Maybank of South Carolina and for the sale of certain utility properties in the system to the South Carolina Public Service Authority. The properties involved include the South Carolina Electric & Gas Co. and the Lexington Water Power Co. These properties are located in the vicinity of the hydro-electric developments on the Santee and the Yadkin Rivers and in Greenwood County. These properties would provide a market for the Santee-Cooper hydro project.

The placing of the service organization on a "request basis" makes it possible for the operating units to place service contract with any outside agency they may choose. They can go outside the system for services or make greater use of their own engineering, financial and service departments. This decision of the trustees was reached after conferences with federal and state regulatory bodies.

A.I.E.E. AT PHILADELPHIA—The first of the broadcasts on the part the engineer is playing in the defense program came at Philadelphia last week during the midwinter convention. L. to r.—John Duer, Philadelphia electrical engineer; Dean Joseph W. Barker, Columbia University; Dr. R. W. Sorensen, president A.I.E.E.; N. E. Funk, vice-president of Philadelphia Electric Co.; with Carl Emory, in rear, (actor) representing John Q. Public in the script. At right are the three winners of the Eta Kappa Nu award. Donald G. Fink, managing editor of the magazine *Electronics*, honorable mention; Dr. Jesse E. Hobson, Westinghouse, winner, and Stuart H. Hight, Bell Telephone Laboratories, honorable mention

NEWS BRIEFS

DAYLIGHT FLUORESCENT LAMPS during the first full year of production accounted for 60 per cent of the output. White was 28 per cent and colors 12 per cent. Last year, however, white was in the lead with 52 per cent, daylight second with 43 per cent and colors in the rear with 5 per cent.

REA POWER is now serving 16 airports, 30 radio-beam and weather-reporting stations and more than 150 airplane beacons located in 32 states. Operating day and night, the radio-beam station uses about 3,000 kw.-hr. a month in winter and about 2,000 kw.hr. in the summer. It has two transmitters of 150 watts each operating on a frequency of 251 kilocycles.

TVA IS USING 6,000 of its employees as human test tubes to determine the effectiveness of a newly developed vaccine believed to provide immunity against the prevalent type of influenza. TVA received 12,000 doses of the vaccine from the Rockefeller Foundation, which has been co-operating in research with the U.S. Public Health Service.

ALMOST 99 PER CENT of Connecticut's homes, farms, commercial establishments and summer residences now have electric service, and about 90 per cent of the state's 15,200 miles of highways are electrically supplied. A hale and hearty Yankee spirit pervades the Nutmeg State, say leading utility men.

MORE THAN 1,500 EMPLOYEES of Virginia Electric & Power Co. registered last October for selective service. These, together with 114 others belonging to reserve components of the Army and Navy, make a total equal to almost one-half of all men employed by the utility.

NEWLY ANNOUNCED BANK DIRECTORS in New England include the following utility men: Frank D. Comerford (Boston Edison and New England Power), Robert E. Freel (Wachusett Electric), A. W. Barstow (Narragansett Electric, Providence), Robert H. Jameson (New England Power Association), and H. C. Hitchcock (Malden Electric). J. T. Dau of Malden Electric is now a vice-president of a local bank. Quite a showing.

PRESIDENT WILLIAM A. HANLEY of A.S.M.E. has advocated graduation of engineering classes of 1942 at least three months in advance of regular dates. He said that 14,000 engineers will be graduated in 1941 but more are needed. He wants intensive study during the summer to put the classes out by February.

A DIAMOND-STUDDED PIN and a certificate of meritorious service went to Joseph D. Fredericks of Bloomfield, N. J., who since 1927 has been assistant to W. R. Burrows, General Electric vice-president in charge of manufacturing, when he attained the distinction of 50 years of service last week. Mr. Fredericks is the eighteenth General Electric employee to reach the half-century mark in years of service. He will be 65 years old on February 27. He joined Edison General Electric Co., a predecessor company, on January 26, 1891, as a tool boy and timekeeper.

GENERAL ELECTRIC has organized the "Forty-Niners" club to fulfill a purpose in arousing interest in buying and using higher levels of illumination. There are plenty of local prizes for those who sell installations of 49 foot-candles or more of general illumination and open to utility, distributor and manufacturer salesmen. Fluorescence should be a natural for the higher intensities. Club members are to get a "Forty-Niner" pin.

•

Maryland to Seek Rate Cuts by Negotiations

The policy of endeavoring to bring about utility rate reductions in Maryland by means of formal negotiations will be continued by the Public Service Commission. This method has been successful in the past, it was said, and has eliminated the necessity of lengthy rate hearings.

The commission stated that it has under way negotiations with several utilities and expects to bring about rate revisions within a reasonable time without resorting to formal proceedings. Last year the commission's Bureau of Engineering tested 44,946 electric meters.

Detroit Edison First to Report Activities

The uncertainties of federal taxes and of coal prices make it difficult to forecast net earnings, A. C. Marshall, president and general manager of Detroit Edison Co., told stockholders in the annual report. However, Mr. Marshall stated, it seems certain that electric output and gross earnings will show a satisfactory increase. He declared that 1941 promises to be another busy year. This is the first utility report issued so far this year.

During the year the company added 30,280 domestic customers and the average use per customer increased from 1,025 kw.-hr. to 1,094 kw.-hr. The number of electric ranges added to the lines increased 17,453 during the year to reach 100,700. The company is now serving all but 3,790 out of about 39,000 farm houses.

The number of employees increased from 6,611 to 7,023 at the end of 1940.

In 1940 Detroit Edison supplied its residential and commercial customers 7,658,287 incandescent lamps and 32,500 range elements and minor parts without charge. The report stated that the company investigated and remedied without extra charge 493,000 minor troubles on customers' premises, 89 per cent within the hour in which they were reported.

Peak load of 866,600 kw. compares with 769,900 kw. in 1939. The company has installed rated capacity of 1,095,675 kw. Total output showed an increase of 16 per cent over 1939.

Detroit Edison has on order a 75,000-kw. turbo-generator for delivery in 1941 and purchased another 75,000-kw. unit last December for future delivery.

Gross earnings for 1940 totaled $65,893,820, against $59,534,611 in 1939. Net income was $10,732,734, against $9,640,295.

Alex Dow, chairman of the executive committee, told stockholders at the annual meeting in New York that despite the large increase in industrial activity in the Detroit area the company has not experienced more than a normal rise in its peak load because manufacturers are now operating on two or three shifts a day.

•

Attack on Italian Dam

Reports from London state that British R.A.F. damaged Italy's power dam on the island of Sardinia. From Rome comes reports that the British attack on the Tirso Dam was without damage. The 197-ft. high dam was completed in 1923 and has installed capacity of 20,000 kw.

Utilities to Buy Power of Elephant Butte Dam

Government's hydro project undergoes final tests — Three 8,100-kw. units to produce 80,000,000 kw.-hr. annually — Spent $2,500,000 to construct power system

The turbid waters of the Rio Grande have been harnessed to supply hydro power for the heart of the cactus and yucca belt of southern New Mexico and jutting western upper valley of West Texas, and after serving their purpose in the turbines of Elephant Butte Dam are recaptured by Caballo Dam for irrigation.

The three 11,500-hp. turbines of Elephant Butte on the Rio Grande in New Mexico, above El Paso, were recently sent spinning as water was released for their operation.

It is estimated that the three 8,100-kw. generators will produce an average annual salable output of 80,000,000 kw.-hr.

Allocate Power

Power to be generated at the plant has been allocated one-half for use in New Mexico and one-half in Texas. El Paso Electric Co., which serves customers in both Texas and New Mexico, will receive more than half of the total output. El Paso Electric serves El Paso, Las Cruces, Hath and Fabens, in addition to numerous smaller communities in the valleys. The utility will obtain the power at rates approved by the Secretary of the Interior on October 14, 1938.

It was back in 1938, under a contract with water users of the El Paso and Mesilla valleys, that the Interior Department obtained hydro-electric rights at the dam and then projected the power system, dividing its $2,500,000 cost as power plant, $1,500,000; transmission lines, $800,000, and substations, $200,000. Congressional appropriations and PWA allotments since 1938 assured completion of the project.

A transmission line being built from Elephant Butte Dam to Las Cruces, where it will connect with El Paso Electric system, is nearing completion. Power will be generated at 6,900 volts, stepped to 115,000 volts for transmission and carried to Las Cruces at 66,000 volts. From Las Cruces the power will go over El Paso Electric's line to El Paso. The $270,000 line from the dam to Las Cruces is being built by the government.

Make System Tests

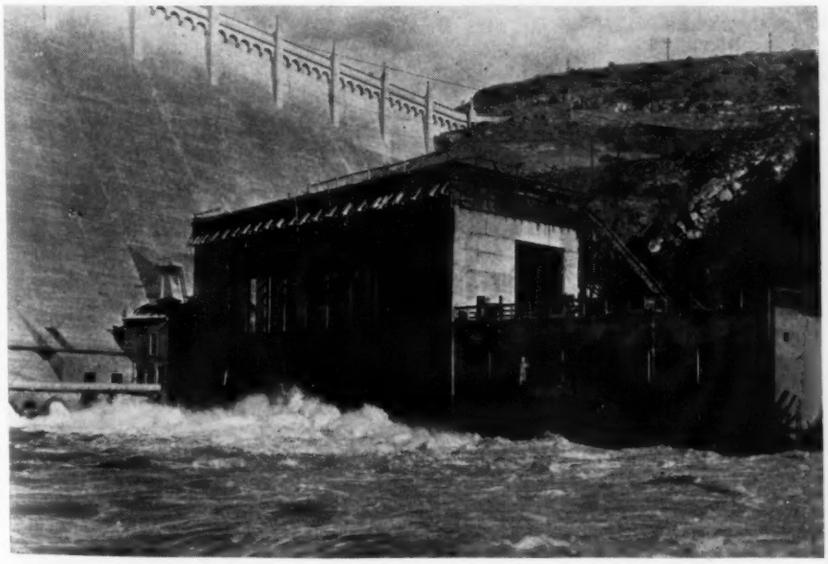
Final tests are being made of the interlocking transmission system, according to L. R. Fiock, superintendent of the reclamation project. The power plant at the dam is now under test, after which energy will be fed into the utility systems.

In addition to El Paso Electric, the government has power contracts with New Mexico Public Service Co., Community Public Service Co. and with the Deming and the nearby irrigation pumping community in the Mimbres valley.

When the $5,000,000 Elephant Butte Dam was constructed, in 1916, provision was made for six penstocks. The obstacle of loss of water for irrigation purposes when power was generated was overcome when the Caballo Dam was constructed several miles downstream. Here the water is recaptured and stored for irrigation after being used to generate power at Elephant Butte.

It is reported that the irrigation dam is responsible for approximately $175,000,000 in gross agricultural income in the area.

Anaconda Wire & Cable Co. was recently awarded a contract for about 350 miles of hollow copper cable to be strung between Las Cruces and Central (near Silver City), N. M., via Deming, N. M.



ELEPHANT BUTTE—Power house at the government's irrigation and hydro project on the Rio Grande River, where tests are being made on the three 8,100-kw. units

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New 30,000-Kw. Unit at Miami Beach Plant

Florida Power & Light Co. is to expand its Miami Beach generating plant on the county causeway at a cost of between $2,000,000 and $2,500,000. A new 30,000-kw. turbo-generator is to be installed in a new addition to be built to the present plant and a warehouse and series of non-inflammable oil storage tanks are to be constructed.

The new turbine will be a single-cylinder, Curtis-reaction, 25-stage machine designed for steam at throttle of 850 lb. and gage pressure of 900 deg. The generator will be hydrogen cooled, designed for 13,800 volts and 3,600 r.p.m.

The steam condenser will be of the surface type designed to use sea water for cooling purposes.

•

Ask Raver to Negotiate

Representatives of seven mid-Columbia public utility districts have asked Bonneville Administrator Paul J. Raver to be negotiator for the group in its plan to purchase jointly the Pacific Power & Light Co. properties in the counties. Districts represented included Yakima, Benton, Franklin, Klickitat and Skamania in Washington and Wasco and Hood River in Oregon.

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Recommends New Agency

The Pacific Northwest Planning Council has recommended that a separate regional agency having the form, rights and powers of a public corporation administer federal power facilities. The suggestion was made to the National Resources Planning Board.

Pacific Gas & Electric Schedules New Plants

Dutch Flat and Cresta projects part of a $27,000,000 construction program for 1941 — New transmission lines to be built — Two 50,000-kva. plants at oil refineries ready this year

Continuing many projects laid down at the end of 1940, Pacific Gas & Electric Co. is at work on a $27,000,000 electrical construction program scheduled for 1941. The figure compares with $26,000,000 of expansion and improvement of electrical facilities in 1940.

Last year began with P. G. & E.'s steam-electric generating program of building stations at oil refineries in full swing. The Avon plant has been completed and the two other 50,000-kva. stations are scheduled for completion in March and July, this year. Other generating improvements last year included reconstruction work at Potter Valley, Phoenix, and Junction City, including modernization for semi-automatic operation, and completion of the 4½-mile tunnel for the Colgate plant, on the Yuba River.

Complete Tower Lines

Transmission items were many and scattered. The 110-kv. twin-circuit tower line from the Avon and Martinez steam plants to Newark substation was completed. A 110-kv. tap was built to serve Ames aeronautical laboratory at Moffett Field. New or rerouted 60-kv. lines were installed between Salinas and Del Monte, between Herdlyn and Newark, and in the vicinity of Chico.

Principal item in the substation program was work started on Piedra substation near Fresno, and on the enlargement of Magunden substation in Kern county. These will increase interchange capacity with Southern California Edison Co. and have a combined installed capacity of 175,000 kw.

Distribution additions amounted to 1,200 miles, raising the system total to some 40,000 miles. An integral part of this was rural extension, on which approximately $1,000,000 was spent. Some 33,000 new meters were set throughout the system.

1941 Program

Scheduled increases in generating capacity include new plants near Dutch Flat on the Bear River and at Cresta on the Feather River. The Dutch Flat plant is estimated to cost $3,210,000, and will deliver 27,000 kw. It involves a 5-mile pressure tunnel boring of which has been started. Another plant on the Bear River, near Colfax, doubtless of similar design and capacity, is the subject of engineering study.

Boring a 4-mile tunnel for the Cresta plant is scheduled to begin this spring. Cresta plant is an $11,100,000 project to develop 75,000 kva., using two machines. Cresta is scheduled for service in the summer of 1943. It is planned to complete a plant at Pulga, immediately below Cresta, in the summer of 1944. Pulga is laid out for two 45,000-kva. generators, and is expected to cost $10,220,000.

The new plants will require new transmission. Scheduled to start in 1941 is work on 110-kv. transmission from Dutch Flat to Halsey Junction, and on a 110-kv. line of 30 circuit miles from Oleum steam plant to the Claremont-Newark line.

In 60-kv. construction will be included a second circuit from Cordelia to Ignacio, rerouting standard lines south of San Francisco and rerouting two sections in the vicinity of Shasta Dam.

Major transformer addition will be a 110/60-kv. substation of 50,000-kva. capacity at East Nicolaus, at a cost of $660,000. At Soledad substation, new 110/60-kv. capacity will be installed, and a future synchronous condenser provided for.

Throughout the system, continued increases in customers and in load are anticipated, according to W. G. B. Euler, chief engineer, perhaps at moderately accelerated rates.

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Wisconsin Power & Light Extends Rural Service

Continuing its program of expanding electric service to farmers, Wisconsin Power & Light Co. spent $446,127 in 1940 to extend service to 1,549 new rural customers, according to Grover C. Neff, president.

With approximately 18,000 customers on the company's rural lines at the end of 1940, Mr. Neff estimated that 83 per cent of farmers in the area who can use electric service efficiently now have it available to them.

New lines or extensions of existing lines built to serve 1,079 new customers totaled 383 miles and were built at a cost of $399,061, an average of $1,039 per mile and $369 per customer, Mr. Neff reported.

In addition to these new customers on new lines, he said, the company added 470 new customers who live under lines previously built, spending $47,066, or slightly more than $100 each, to provide transformers, meters and service wires and poles.

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Wisconsin Utility Will Add Turbo-Generator

Superior Water, Light & Power Co. has been authorized to install additional generating facilities at its Hughitt Avenue station in Superior at a cost of about $1,550,000, the Wisconsin Public Service Commission reports.

"The applicant estimated that the energy generated by the plant would cost 1.126 cents per kilowatt-hour and that the plant would generate 45,000,000 kw.-hr. per year."

Included in the new construction program will be a 12,500-kw. turbo-generator with boiler, electric and mechanical auxiliary equipment, substation and switching equipment, including necessary building changes and additions, and the rearrangement of certain facilities now located at the Hughitt Avenue station.

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Wages-Hours Law Held Applicable to Co-ops

An opinion that rural electric cooperatives are subject to the state law governing wages and hours of women and minor employees was given recently in Kentucky by Assistant Attorney-General Guy H. Herdman to Leland Logan, Bowling Green attorney. Mr. Herdman declared that while the co-operatives receive federal aid, they are "domestic corporations and subject to the general laws of the state, except as expressly exempted," and that the wage-hour law was "not a tax but a protection for women and children employed."

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Change Meters to Outside

Northern Indiana Power Co. is planning to change all meters now inside houses to outside installations, according to William M. Large, Huntington, Ind., district manager. Mr. Large said that the company has spent $125,000 in Huntington in the last year improving its distribution system to the point where its power capacity is doubled.

Cities Service Files with SEC Under Act

Having been denied exemption under the Public Utility Holding Company Act, Cities Service Co. registered with the SEC last week and began consideration of methods by which it could comply with its provisions.

Previously the company had sought exemption by virtue that it was only incidentally a utility holding company because the bulk of its business was derived from oil and other related operations.

Registration followed promulgation of a new exemptive rule by the SEC whereby subsidiaries of registered holding companies engaged in petroleum, production and transportation of natural gas, or real estate business, are exempted from certain important provisions of the utility act. The exemption applied only to those companies that registered after January 24, the effective date of the rule. By the rule, SEC continues to exercise jurisdiction over non-utility enterprises.

SEC served notice on Cities Service that it must split itself into independent halves, one taking the utility properties and the other the non-utility properties. W. Alton Jones, Cities Service president, expressed the belief that SEC had taken a most important and constructive step in administering the act. Mr. Jones said that the company will proceed in due course to work out a plan to comply with all provisions of the act, including the integration provisions.

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Set Hearing on PUD Sale

Federal Power Commission has directed that a public hearing be held concerning the application of the Iowa-Nebraska Light & Power Co. for authority to sell the major portion of its electric utility properties located in the State of Nebraska to the Consumers Public Power District of Nebraska at a proposed purchase price of $19,465,000. The hearing will be held on February 10.

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Defers Connecticut Case

Federal Power Commission, acting upon application of the Connecticut Light & Power Co., has postponed until March 18 the public hearing previously scheduled to begin on February 11 on a show-cause order citing the company's failure to comply with numerous orders, requirements and requests of the commission.

INFRA-RED CONFERENCE—Representatives of manufacturing and public utility organizations from many parts of the East at the conference on infra-red electric heating principles and application held at M.I.T. last week under the auspices of the Power Engineering Association of New England

Boston Meet Airs Infra-red Problems

Under the auspices of the Power Engineers Association of New England, 225 representatives of manufacturing and public utility organizations from many parts of the East attended a conference on infra-red electric heating principles and applications last week at the Massachusetts Institute of Technology in Cambridge. P. N. Rugg of the Boston Edison power sales department presided.

The program covered an exhaustive presentation of the chemical, physical and engineering aspects of this rapidly developing branch of electric service. In the discussions the importance of continued investigation and development of the use of this comparatively new industrial tool was stressed.

It was brought out that the annual per kilowatt load revenue value of infra-red heating in many cases equals the first cost of the installation per kilowatt. That is, in a layout costing $30 per kilowatt, the central station income would be about $30 per kilowatt of connected load, a ratio difficult to reach in many other lines of electrical activity. Many applications were shown in which striking savings in processing time were achieved, and there was also some discussion of borderline applications involving drying of highly saturated material encountered in paper making and other industries where further research in connection with infra-red is necessary to attain the success realized in other fields. Much progress was apparent in equipment design, both from the standpoint of operating flexibility, economical use of energy and control of ventilation and temperature conditions.

Among the principal speakers were Prof. Gordon B. Wilkes, M.I.T.; Howard Haynes, engineering department Nela Park, G.E. Co., Cleveland, Ohio; R. N. Green, manager of development and engineering, Fostoria Pressed Steel Corp., Fostoria, Ohio; Norman J. Thompson, Director of Laboratories Associated Factory Mutual Fire Insurance Cos., Boston; J. W. McDaniel, District Manager Ault & Wiborg Corp., Cleveland; D. Aitken, infra-red specialist, Cleveland Electric Illuminating Co.; J. B. Wynne, superintendent Boston Wire Stitcher Co., East Greenwich, R. I.; Frank Nolan, President, Saart Bros., Attleboro, Mass., and J. E. Garrod, Supervisor of Process Service, Hood Rubber Co., Watertown, Mass.

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$200,000 Bond Vote

Mayor D. D. Pinion of Caruthersville, Mo., has announced that a special election on a $200,000 bond issue for a municipal light and power plant will be held March 3. A two-thirds majority is necessary for passage.

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Improves City System

The town of West Point, Iowa, has awarded a contract to the Electric Equipment Co., Des Moines, at $32,423 for construction of extensions and improvements to the municipal electric system.

Santee-Cooper Seen a Defense Necessity

The Office of Production Management has informed Federal Works Administrator Carmody that it considers the Santee-Cooper hydro-electric power project in South Carolina a "necessity to national defense" and wants it completed as promptly as possible.

The effect of the announcement will be to permit priority ratings to be issued where necessary for machinery or supplies needed to complete the project. Santee-Cooper, being built by the South Carolina Public Service Authority with PWA funds, is near the half-way mark. It is scheduled to be completed late this year and will have a rated capacity of 133,000 kw.

In his letter to Mr. Carmody, OPM Director General Knudsen says his office is advised the Aluminum Co. of America is seeking 30,000 kw. and Commonwealth & Southern system 50,000 kw. to serve national defense projects now or about to come onto its lines, and that the authority is negotiating with a Pittsburgh concern for power for a ferro-alloy plant at Charleston.

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Rocky Mountain Body Approves Sales Plan

A twelve-point sales and promotion program for member utility companies in the states of Colorado, Arizona and New Mexico was presented and approved at the midwinter meeting of the Rocky Mountain Electrical League, held in Denver. Plans for the league's 1941 convention in Estes Park, Colorado, and the program of the parallel engineering and accounting division meetings, scheduled for March 14-15 in Denver, were discussed.

The sales and promotion program was outlined by G. B. Buck, vice-president of the Public Service Co. of Colorado and newly elected president of the league. As adopted, the program will embrace adequate wiring, kitchen modernization, better light-better sight, commercial fluorescent lighting, street and highway lighting, rural electrification, personnel development, employee-customer relations, table appliance promotion, electrical expositions and Christmas lighting.

Material expansion of the league's adequate wiring program was discussed. Under the guidance of T. M. Foulk, newly appointed chairman of the Adequate Wiring Bureau, demonstrations and meetings of the bureau are to be held throughout the territory. Arrangements are being considered for joint meetings of electrical contractors, architects and builders, the first scheduled for Albuquerque. It was recommended by several delegates that the league become more closely concerned with the load-building activities of various rural electrification projects and also that greater attention be given to employee and customer relations.

Innovation for the Rocky Mountain League will be the introduction of a temporary lighting institute under the direction of J. M. Ketch of General Electric Co. The proposed "institute" has just completed a tour during which it was used as the medium for presenting some of the latest applications of lighting. It was planned to present the lighting institute on the day and evening preceding the engineering and accounting section meetings.

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Resume Negotiations

Negotiations for the purchase of properties of Puget Sound Power & Light Co. have been resumed in Seattle. First meetings were held in New York.

MEETINGS

Edison Electric Institute—Electrical equipment committee, Statler Hotel, Detroit, Mich., February 10-12; transmission and distribution committee, Statler Hotel, Detroit, February 17-19. Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 31-April 4. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 17-20. A. H. Parsons, secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association—Winter meeting, Palmer House, Chicago, Ill., February 17-21. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

American Society for Testing Materials—Spring meeting, the Mayflower, Washington, D. C., March 4-5; committee week, the Mayflower, March 3-7. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Oklahoma Utilities Association—Annual convention, Tulsa, Okla., March 17-18. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

Northwest Electric Light and Power Association—Annual meeting, Business Development Section, Davenport Hotel, Spokane, Wash., March 27-29. Daryl B. Leonard, chairman, Pacific Power & Light Co., Yakima.

American Society of Mechanical Engineers—Spring meeting, Atlanta, Ga., April 1-3. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Midwest Power Conference—Fourth annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles N. Nash, conference secretary, Illinois Institute of Technology, 3300 Federal St., Chicago, Ill.

Electrochemical Society—Spring meeting, Cleveland, Ohio, April 16-19. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Missouri Association of Public Utilities—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 23-25. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Illuminating Engineering Society—Pacific Division, second annual lighting conference, Pacific Gas & Electric Co. auditorium, 245 Market St., San Francisco, April 25-26. William P. Bear, general chairman, 245 Market St., San Francisco.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 18-22. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

House Cuts Budget of FPC for Year

The House of Representatives has over-ridden the President's recommendation of a $95,000 increase for Federal Power Commission salaries during the fiscal year beginning July 1. The $2,470,000 voted FPC is $3,500 less than the amount the agency has to spend this year.

Of the total, $2,235,000 is for salaries and expenses, the same amount as for the current year. In its report, the House appropriations committee said of the recommended $95,000 salary increase that the money was not "absolutely essential" in view of the general policy of not expanding normal governmental activities. FPC was voted, in addition to salaries and expenses, $150,000 for carrying on its national defense power studies—an amount equal to that allotted it from the President's "blank check" money this year—and $42,000 for printing, a cut of $3,500.

The Securities and Exchange Commission's $5,440,000 budget went through the House unchanged. It contains $50,000 additional funds for expenses of enforcing the new investment trust act and a $10,000 reduction in printing allowance. All other items are unchanged from the present year.

Also contained in the omnibus independent offices appropriation bill was $69,800,000 for the Tennessee Valley Authority, an increase of $4,800,000 from the current year's total of regular and "defense program" appropriations. Of this sum, nearly $40,000,000 is for TVA's regular program, the same figure as for the current year, and the remainder, including the increase, is for the special defense program.

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Frank H. Golding Dies

Frank H. Golding, chairman of the trustees of the New England Gas & Electric Association, died suddenly on February 3. Mr. Golding had been prominently identified with the public utility industry in New England since 1923.

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Sales of Georgia Power

Merchandise sales of Georgia Power Co. for the first eleven months of 1940 totaled $2,614,036. Of this amount $1,716,632 represented domestic sales, $502,258 all-employee small appliance sales and $395,145 commercial sales. The average annual residential use was 1,518.3 kw.-hr., against 1,446 kw.-hr. for the year 1939.

Output Gain Over '40 Is Largest of Year

In a lateral movement from the preceding week, production of electricity in the week ended February 1 was 2,829,690,000 kw.-hr., according to the Edison Electric Institute, a gain of 11.3 per cent above the corresponding week of last year. This was the largest gain over the previous year since the week ended August 3, 1940. The margin over the similar week of 1939 was 23.7 per cent for the week ended February 1.

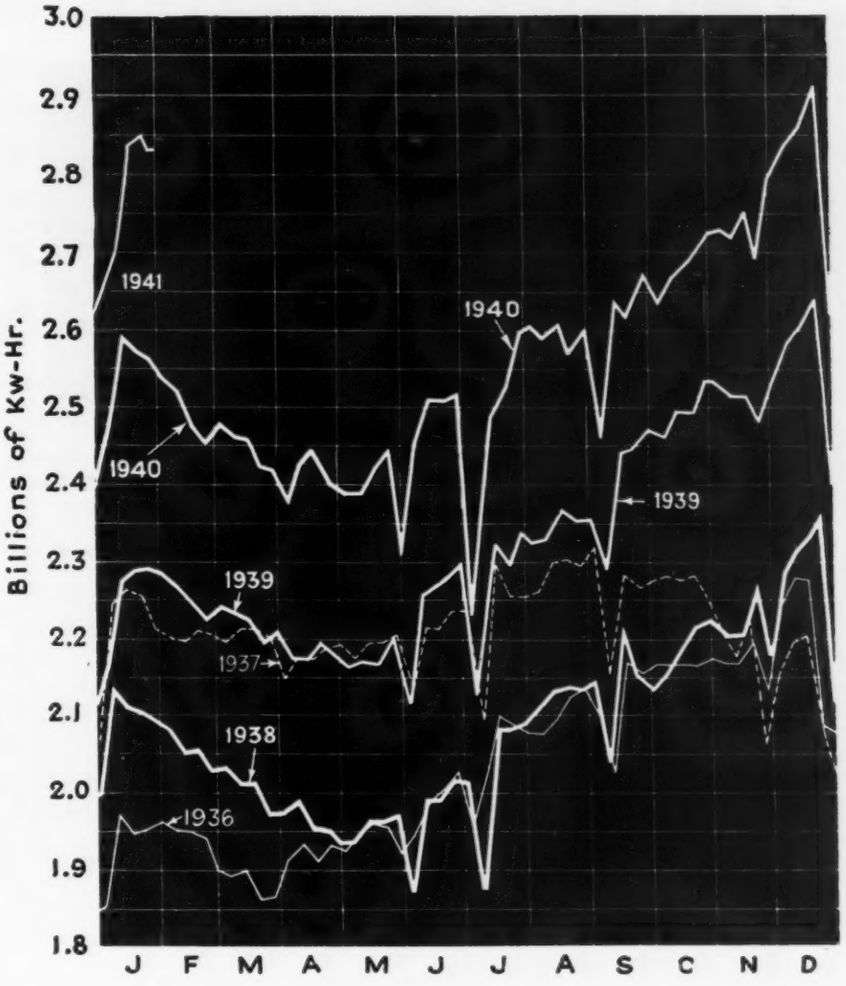
For the first five weeks of this year electricity output totaled 14,042,923,000 kw.-hr., approximately 10.2 per cent more than was produced in the same period a year ago. In the most recent week output was within 2.8 per cent of last winter's record; corresponding decreases for 1940 and 1939 were 3.8 and 3.2 per cent, respectively.

Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Feb. 1	2,830	Feb. 3	2,541	Feb. 4	2,287
Jan. 25	2,830	Jan. 27	2,566	Jan. 28	2,293
Jan. 18	2,844	Jan. 20	2,572	Jan. 21	2,290
Jan. 11	2,835	Jan. 13	2,593	Jan. 14	2,270
Jan. 4	2,705	Jan. 6	2,473	Jan. 7	2,169
1940		1939		1937	
Dec. 28	2,623	Dec. 10	2,404	Jan. 1	1,998
Dec. 21	2,911	Dec. 23	2,641	Dec. 25	2,085
Dec. 14	2,862	Dec. 16	2,605	Dec. 18	2,202
Dec. 7	2,838	Dec. 9	2,586	Dec. 11	2,196
Nov. 30	2,796	Dec. 2	2,539	Dec. 4	2,153

Per Cent Change from Previous Year

	Week Ending		
	Feb. 1	Jan. 25	Jan. 18
New England	+ 8.5	+ 8.1	+ 8.6
Middle Atlantic	+10.9	+ 8.5	+ 9.2
Central Industrial	+15.6	+14.0	+14.0
West Central	+ 9.8	+ 8.1	+ 9.0
Southern States	+10.0	+ 9.3	+ 8.6
Rocky Mountain	+ 3.9	+ 4.8	+ 7.3
Pacific	+ 7.5	+ 7.3	+ 7.4
United States	+11.3	+10.3	+10.6



Increased margin of output in the week ended February 1 over a year ago was reflected by all the major geographic regions except the Rocky Mountain. That in the Middle Atlantic section, 10.9 per cent, was the largest for this region since the week ended January 13, 1940.

Peak Energy Output Is 11% Above 1939

Production of electricity in the United States during 1940 totaled 144,965,000,000 kw.-hr., according to preliminary estimate of the Federal Power Commission, an all-time high and approximately 11 per cent more than was produced during 1939. Of the total energy reported, 2,719,000,000 kw.-hr. were produced by electrical railroads, electric railways, and other miscellaneous plants.

Average daily production of electricity reached a record point during December for the third consecutive month, amounting to 424,932,000 kw.-hr., 2.0 per cent more than the daily average for November and an increase of 11.1 per cent over the previous December. Total production for December was 13,172,889,000 kw.-hr., excluding production by plants generating principally for their own use.

Of the total production estimated for 1940, 33 per cent was produced by the use of water power, approximately an 8 per cent increase over 1939. The average for the 21-year period from 1920 to 1940 is 36 per cent of the total.

Total installed capacity of generating plants available for service as of December 31, 1940 was 41,576,000 kw., a net increase of 1,258,000 kw., or 3.1 per cent over December 31, 1939.

Coal consumption increased approximately 16 per cent, or about seven million tons over 1939. Oil consumption decreased 4 per cent, or about 700,000 barrels. Gas consumption was 4 per cent less, or about 8,000,000 M cu.ft.

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Texas Power Consumption

While December consumption of electric power in Texas gained 5.8 per cent over December a year ago, the total consumption for 1940 was practically the same as in 1939, the University of Texas Bureau of Business Research reports. Industrial use of electricity last year dropped 7.1 per cent below 1939, while other types of consumption—commercial, residential and miscellaneous—showed gains ranging from 5.5 per cent to 8.2 per cent, the Bureau revealed.

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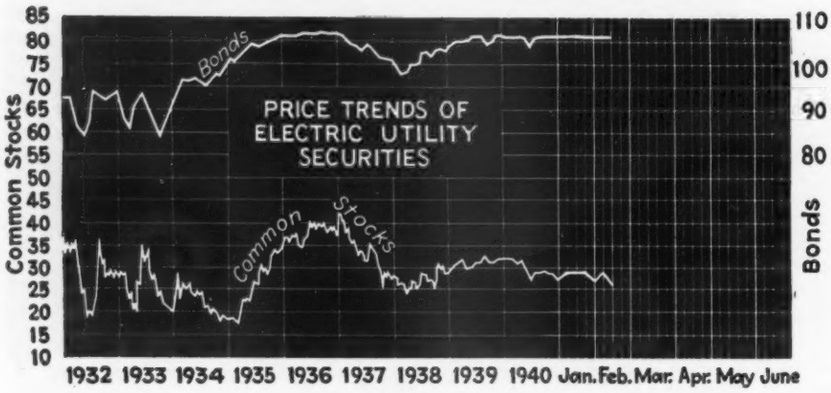
Propose City-Owned Plant

Mayor Frank Buchanan and the Lebanon (Tenn.) board of aldermen in a special session have instructed William D. Baird, city attorney, to draft an enabling act authorizing Lebanon to issue bonds "not to exceed $325,000" for construction of a municipally owned and operated power plant. The bill will be introduced in the Legislature and will give the city the right to operate its own plant or purchase power from TVA.

Utility Stocks Lose Ground; Bonds Lower



Following the general market trend toward lower levels, utility stocks moved downward this week. "Electrical World" index, 26.4; last week, 27.0; last year, 31.8. "Electrical World" bond index receded slightly from 106.2 the preceding week to 106.1

Large Utility Issue Placed on Market

Offering has been made of a new issue of $26,500,000 of first mortgage 3¼ per cent bonds, and 132,000 shares of preferred stock, 5 per cent series, of the Wisconsin Public Service Corp. The bonds mature January 1, 1971, and were priced at 106 and interest. The preferred stock of $100 par value, was priced at $105 per share. Of the new preferred stock, 118,500 shares were offered by the bankers subject to the prior par-for-par exchange offer made by the company to holders of its old preferred stock issues.

As a result of this financing, Wisconsin Public Service Corp. will effect an important step in the simplification of its capital structure, and will reduce interest and preferred dividend costs. The refunding of two outstanding issues of bonds and three outstanding issues of preferred stock with one mortgage bond issue and one preferred stock issue will be carried out through the proceeds of these new offerings and the sale of 200,000 shares of the company's common stock to the parent company, Standard Gas & Electric Co.

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Share Exchange Offered

Holders of the 6 per cent and the 7 per cent preferred stocks of the Lake Superior District Power Co., a unit in the Middle West System, have received the offer of the right to exchange their shares for a new 5 per cent preferred stock of the company on a share-for-share basis. In addition, those accepting the exchange will receive $7.50 a share in cash. This represents the difference between the offering price of $102.50 a share for the new preferred stock and the redemption price of the old stocks. The exchange offer will expire on February 8.

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Seeks to Amortize Redemption Premiums

Appalachian Electric Power Co. has filed a petition with the Federal Power Commission for permission under Balance Sheet Instruction 6-E of the commission's Uniform System of Accounts to amortize the redemption premiums of $3,420,000 paid in connection with the retirement of its then outstanding $57,000,000 principal amount first mortgage bonds, at the rate of $9,500 per month, throughout the term of its 3¼ per cent first mortgage bonds, issued and sold during December 1940, due December 1, 1970.

The petition states that the company's 3¼ per cent first mortgage bonds, dated as of December 1, 1940, in the principal amount of $70,000,000, were issued and sold in the month of December. The petitioner states that amortization of redemption premiums of $3,420,000 on the retired issue, at the rate of $9,500 per month, over the life of the $70,000,000 issue, has been authorized by the State Corporation Commission of Virginia and the Railroad and Public Utilities Commission of Tennessee.

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State Board Authorizes New Bond Offerings

Maine Public Utilities Commission has authorized the Central Maine Power Co. to issue bonds in the amount of $1,250,000 to bear interest at 3½ per cent.

The board has also authorized the Bangor Hydro-Electric Co. to issue $750,000 first mortgage bonds due in 1966 at 3 per cent. The proceeds would be used for construction and purchase of new equipment, including construction of a storage dam at Grand Lake.

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Will Hear Disposal Plan On Utility Write-Up

Federal Power Commission has ordered that a rehearing be held on February 10 for the purpose only of permitting the Northwestern Electric Co. to present its plan of disposition of the $3,500,000 common stock write-up for which the commission directed specific accounting in its order of December 6, 1940.

Acting upon an application filed by the company on January 9, the commission denied a rehearing in all other respects and reaffirmed its order and Opinion No. 56 entered on December 30, 1940.

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Will Cut Debt Interest

An application by the Public Service Electric & Gas Co. to reduce from 3½ per cent to 3⅛ per cent the annual interest on a $55,000,000 bond issue maturing in 1965 has been approved by N. J. State Board of Public Utility Commissioners. All but $5,000,000 of the issue, the board noted, was privately owned.

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New Directors Elected

At a recent meeting of the directors of the Pennsylvania Water & Power Co., Prescott S. Bush of New York, Laurence G. Tighe, of New Haven, Conn.; and Theodore E. Seelye, of Philadelphia, were elected directors to fill vacancies on the board.

Utility Reports

	Net Income 1940	1939
*Alabama Power	$3,017,252	$4,118,973
*Commonwealth & Southern and subs.	13,048,510	13,413,636
*Cons. Gas, Elec. Lt. & Pwr. (Balti.) and sub.	6,255,324	6,805,831
*Consumers Power	10,965,858	9,675,223
†Duquesne Light	9,778,117	10,205,833
*Georgia Power	4,563,124	4,984,154
†Louisville Gas & Elec. (Del.) and subs.	1,467,076	1,348,353
*Nevada-Calif. Elec. and subs.	570,252	305,898
†Northern States Power	6,632,889	5,500,133
*Ohio Edison	4,146,213	4,171,777
*Oklahoma Gas & Electric	2,539,618	2,778,505
†Philadelphia Co. and subs.	6,028,875	6,036,257

* Twelve months ended December 31.
† Twelve months ended November 30.

...TO BUILD THIS NEW MOTOR

2 Extra Protection

AGAINST ELECTRICAL BREAKDOWN

Stator winding of Formex* wire—the toughest magnet wire ever developed—gives extra protection against moisture, oil, abrasion, and heat-aging. New synthetic-resin bonding varnish and Glyptal No. 1201 Red on end windings make a sturdy unit with a durable finish. You get a motor you can count on for continuous service year after year.

*Reg. U.S. Pat. Off.

3 Extra Protection

AGAINST OPERATING WEAR AND TEAR

Sleeve bearings are of new design —have a scientifically determined length and diameter and a method of grooving that assures a continuous oil film over the entire bearing surface. A new and simple ball-bearing mounting assures correct alignment and exclusion of foreign materials—bearings can be cleaned and greased without disassembling.

OUR field studies had shown that, more and more, the requirements of industry were demanding a vastly improved general-purpose motor, and it was apparent that this demanded a radically new approach on the part of the designer. Similarly, design studies showed that only by making a fresh start could full advantage be taken of the materials and methods that were newly available. Only by matching up *all* the new wants and *all* the new ways of doing things, in a supreme effort to make a *long jump* ahead—instead of the traditional *step* ahead—was it possible to achieve the truly modern motor you asked for.

And now you have the Tri-Clad motor—a completely new design. More than 15 important improvements have been built into it. And for the reason that so many major improvements were concentrated in one design, we had to have just that much more assurance that each one was thoroughly practical. Never before, we believe, has the manufacturer required a motor to prove itself so thoroughly in advance of initial sale.

Whatever the task you have for a general-purpose motor —whatever your special concern for appearance, convenience, quietness, *or* protection—you will find that the performance-tested features of the Tri-Clad motor will give you specific benefits on the job. General Electric, Schenectady, N. Y.

1, 1½, 2, 3, and 5 hp now available—
larger sizes will soon be ready

GENERAL ELECTRIC

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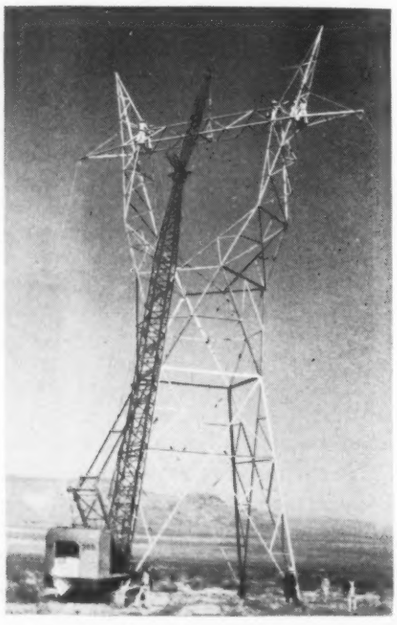
OPERATING PRACTICES

High Crane Cuts Tower Costs

By CLAYTON M. ALLEN
Assistant General Construction Superintendent
Los Angeles Bureau of Power & Light

Upon analyzing costs of constructing its third 287.5-kv. transmission line from Boulder Dam, the Los Angeles Bureau of Power & Light has found savings of more than 50 per cent in the cost per ton of erecting level country standard suspension towers. This figure is in comparison with those for the first two circuits.



CRAWLER CRANE with 105-ft. boom is operating near its limit as crew places crossarm (90 ft. from ground) on standard suspension tower of Los Angeles-Boulder transmission line

An important factor in effecting this economy was the use of a long-boom crawler crane. This was used in place of the usual floating ginpole.

The third circuit involved 1,426 towers, with a total weight of 16,300 tons. Use of the long-boom crawler crane permitted completion of three standard 90-ft. (to crossarm) suspension towers in each shift.

The crane was a P & H gasoline-driven crawler, equipped with a 105-ft. boom, made up of an 80-ft. boom plus a 25-ft. jib. Its operator worked in conjunction with a crew consisting of strawboss and tower crew of six groundmen and six high men.

Eleven separate lifts were made on the 90-ft. towers, the members having previously been assembled and bolted up on the ground by layout and bolt-up crews using a specially adapted truck-mounted derrick.

Other towers in the line—standard 100-ft. units, measuring 120 ft. from ground to the tip of the ground-wire peak—required slightly more time to erect.

Construction of the 259-mile third circuit, like that of the first two circuits, was under the direction of R. R. Robertson, engineer of construction for the bureau.

•

Safety Holder for Steel Guy Wire

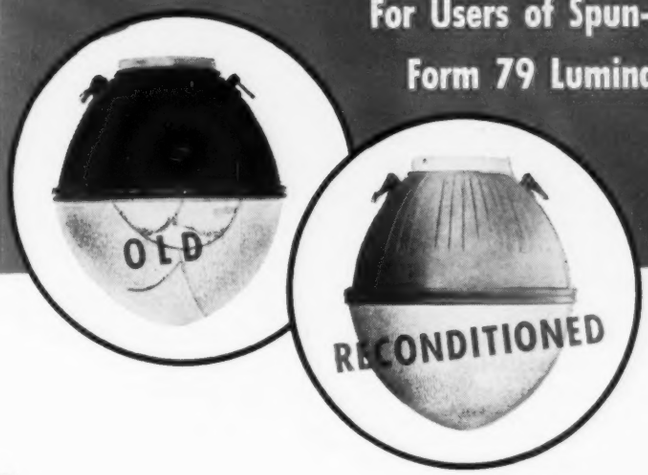
Safe handling of guy strand in the field, particularly the larger sizes and higher strengths, is facilitated with a new safety holder in which the guy wire may be carried to the job and from which it is paid out from the center, in much the fashion as rope from the inside of a coil.

The holder accommodates a coil of wire to 30 in. in diameter and 6½ in. deep. The entire coil, with binding wires intact, is rolled into the holder and secured with a latch. Then the binding wires are removed and the coil expands to fill the holder. The inner and outer ends of the strand are secured to the

GUY STRAND is rolled into the safety holder and latched in (left), carried to the job on the utility truck and then to the pole on the shoulder of the lineman (center), where it is paid out (right) as the lineman trails the strand after him

Explaining the Only RECONDITIONED REFLECTOR EXCHANGE PLAN

For Users of Spun-sealed Form 79 Luminaires



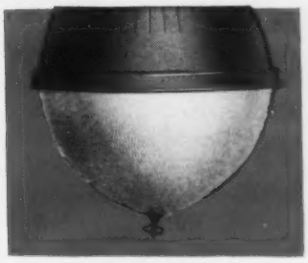
OFFERING you an "over the counter" service to replace damaged Form 79 spun-sealed, reflector-glass assemblies with complete reconditioned units. G-E warehouses, located in every section of the country, carry stocks of reconditioned reflectors; there is no need to return the damaged reflectors to the factory. Those who have used this plan recently know that the reconditioned reflector has all the latest improvements—new toggle latches, durable Glyptal finish, and the stepped reflector to reduce temperatures at the lamp stem.

Many electric-service companies have accepted the frequent replacement of glassware as a necessary evil; and often unnecessarily so, because spinning the aluminum reflector to the globe protects the glass edge against chipping and damage. An eastern utility, with 775 Form 79 luminaires, reported 11 globe replacements—only 4.63 cents a year for breakage.

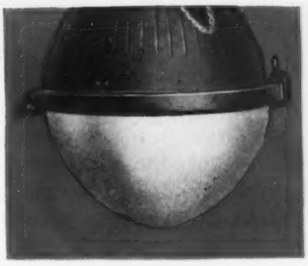
Whether you use the spun-sealed globe holder or the detachable type—General Electric manufactures both—with Form 79's you can be sure of stronger glassware and less breakage. Pressed glassware of greater-than-ordinary thickness and uniformity now assures even greater mechanical strength, and the smooth-finished edge resists chipping due to handling and temperature changes.

Better become acquainted with the G-E Form 79 luminaire. It's the first choice for lighting America's streets and highways. General Electric, Schenectady, N. Y.

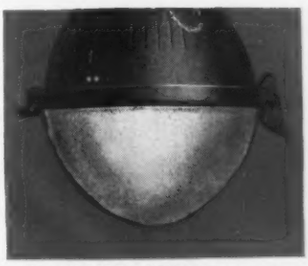
FORM 79 UNITS WITH DETACHABLE GLASSWARE*



The **BAIL-TYPE** holder has two spring metal bands attached to the reflector and extending downward into the bottom of the globe. A nut threads onto this globe support and holds the globe securely in compression against a cork gasket on the rim of the reflector.



This **C-CLAMP** construction has a cast holder clamped around the base and hinged to the reflector rim. A C-clamp latch seats the globe against a heavy felt gasket. Luminaire is serviced by either unlatching globe or joint between hood and reflector.



The **ROLLER-LATCH** construction permits relamping from the ground with a lamp remover. A push on the spring latch allows the globe holder to swing open; an upward thrust on the globe swings and locks it shut.

*These models are not included in the exchange plan.

GENERAL ELECTRIC

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holder. If the upper guy loop is made up in advance on the ground, then the desired length of guy strand is paid out from the inside of the coil. Otherwise, the coil in its holder is carried to the job on the truck.

On arriving at the job the holder and coil may be carried to the pole on the shoulder of the lineman. There the lineman climbs the pole, trailing the guy strand after him as it is unreeled from the inside of the holder. By confining the strand in the holder in this way danger of traffic accidents is minimized and no assistant is required to control the guy wire coil.

•

Boost Breaker Rating, Release Space

By C. F. AUSTIN
Supervising Design Engineer
Commonwealth Edison Company, Chicago

Until recently, when the 9-kv., 25-cycle and 12-kv., 60-cycle oil circuit breakers and buses at the Ravenswood substation of the Commonwealth Edison Company of Chicago were modernized, the low capacity of the oil circuit breakers was a hazard to the system and the awkward bus arrangement, resulting from system changes, was a menace to emergency operating.

Although these conditions were long realized, lack of space for tank-per-pole breakers prevented earlier modernization. However, the advent of 500,000-kva., three-poles-per-tank, factory-assembled oil breakers in 3-ft. steel compartments provided means for securing adequate rupturing capacity and much-needed space for future growth.

The present substation building occupies the entire lot and contains two 4,000-kw., 25-cycle and one 3,000-kw., 60-cycle synchronous converters and one 3,125-kw., 60-cycle mercury-arc rectifier for 600-volt railway service. Two 7,500-kva. and two 5,000-kva., 60-cycle transformers supply the 4-kv. circuits.

The 9-kv. and part of the 12-kv. oil breakers date from 1913 and 1914 and have rupturing capacities of 25,000-kva. or less. Later 12-kv. oil breakers are rated at 150,000 kva. rupturing capacity. These oil breakers were arranged in two parallel rows across the substation on the operating floor.

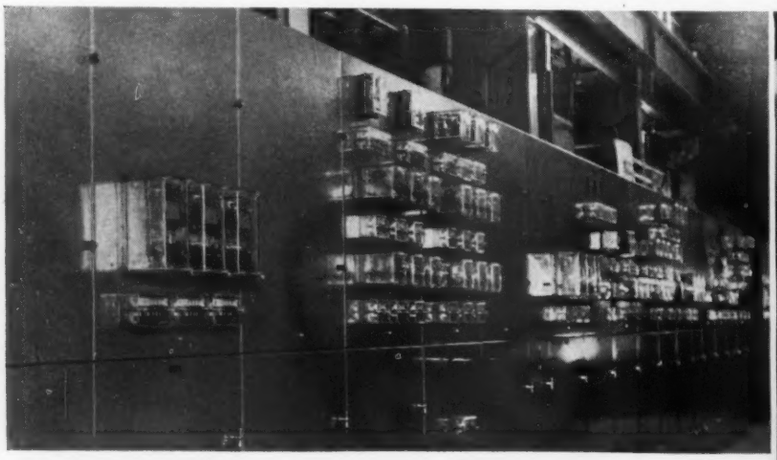
As previously stated, the lack of space for tank-per-pole breakers prevented earlier modernization. The procurement of additional land adjacent to the substation for a switch and transformer house was not feasible and the addition of a balcony in the railway portion of the substation was impracticable due to ventilation difficulties with the railway converters and the cost of erection over live buses and equipment.

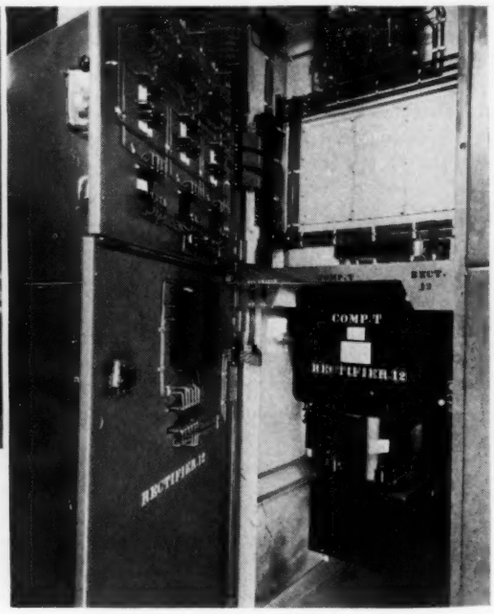
Recourse to 500,000-kva., three-pole-per-tank, factory-assembled oil breakers in a 3-ft. steel compartment made possible the installation of 22 9- and 12-kv. breakers in one row on the operating floor of the substation. The size of the compartments allowed as many as six to be shipped and set in place as a unit. A few temporary cutovers permitted the entire new installation to be placed in service in three steps without affecting service.

The main equipment groups, buses, instrument transformers, oil breaker and control wiring are separated from each other by grounded steel barriers. Relays and instruments with their test switches are mounted on the upper front compartment doors. Control switches, indicating lights and bus voltmeters are mounted on a small compartment at the end of the 12-kv. structure. The buses are protected by bus differential relaying.

While the electrical failure of properly maintained modern oil breakers is remote, this compact arrangement of the switching equipment contains elements which may offer some difficulty in making future repairs or replacements. The bus arrangement is fixed at the initial installation of this type of gear by the connection requirements of the ties. In a growing substation this lack of interchangeability of the bus ties with other compartments may require additional spare compartments. It has been found desirable to use motorized trucks for handling the 500,000-kva. common tank breakers when removed from the compartment elevating mechanism.

These disadvantages were outweighed in this case by securing equipment of ample rupturing capacity while saving valuable space.





THREE-POLES-PER-TANK 9- and 12-kv. oil breakers in factory-assembled compartments increase breaker ratings, improve bus arrangement and provide space for expansion at Ravenswood substation (left). Buses, instrument transformers, breaker and control wiring are separated by grounded metal barriers. Relays and instruments and their test switches are on upper front compartment doors (right)

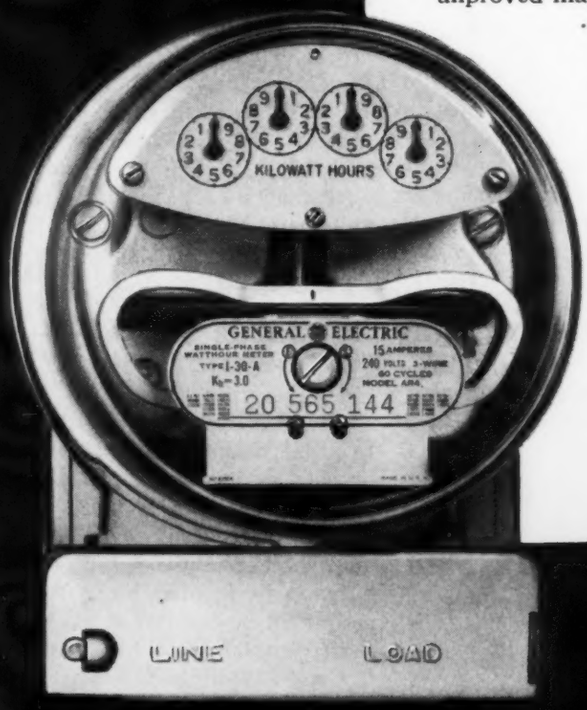
WHY ALNICO MAGNETS ?

THE characteristic properties of alnico are such that, from the very beginning, General Electric engineers have regarded it as a promising material for watthour meter damping magnets. Experience with its use in many General Electric products has borne out the early predictions.

However, permanent stability of the damping magnet is the one essential that will assure continued accuracy of a watthour meter. A premature decision to use an unproved magnetic material, however attractive, might damage the reputation for sustained accuracy now possessed by General Electric watthour meters.

Therefore, the decision to use alnico was made only after a thorough study of all operating conditions, and after conclusive tests had been made over a period of years to prove the magnetic stability of this alloy. Then, processing the alloy and manufacturing the magnets presented many new problems. These have been successfully solved, so that full advantage can now be taken of the excellent properties of this alloy.

Alnico magnets now used in General Electric watthour meters give added assurance of sustained accuracy, under all operating conditions, because of their inherently high resistance to demagnetization.



GENERAL ELECTRIC

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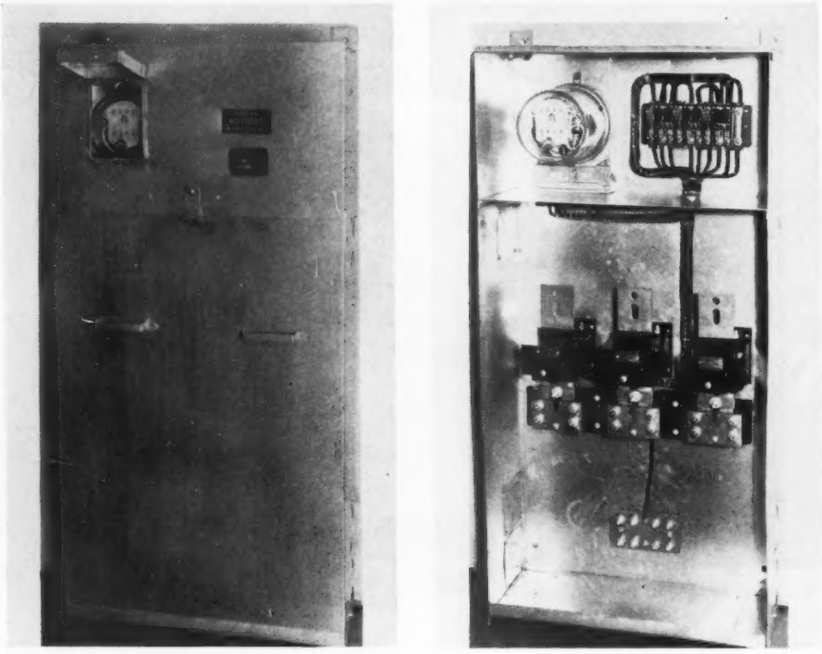


OUTDOOR METERING EQUIPMENT for construction service is lighter and costs less than previous units. Current transformer metering unit, shown with and without cover, has capacity of 100 to 900 amp., for three-phase, four-wire service

Metering Units for Construction Service

By G. F. ELSEN
Assistant Engineer Consolidated Edison Company of New York, Inc.

To reduce the number of units required as well as the cost and weight per unit, three units have been designed and standardized by Consolidated Edison Company for metering temporary construction services. In our previous design the cabinets were unusually heavy, making the units cumbersome to handle. The largest of the three new units, which accommodates current transformers, weighs less than 150 lb., as compared with nearly 400. Cost has been reduced to the point where it is economical to use this cabinet for a number of installations and discard it when it becomes damaged by rough usage.

Cabinet of the current transformer metering unit is divided into two compartments, separated by a barrier and provided with separate covers. Lower compartment houses the current transformer and upper the watt-hour meter and connection block. Since the upper compartment cover interlocks with the lower, only one lock or seal is needed.

The newly developed low-voltage current transformers, which are both low in cost and light in weight, are used.

Because of its wide range of capacity and high degree of metering accuracy only the 600-amp. size of transformer is used. This allows it to be left in the cabinet for certification tests.

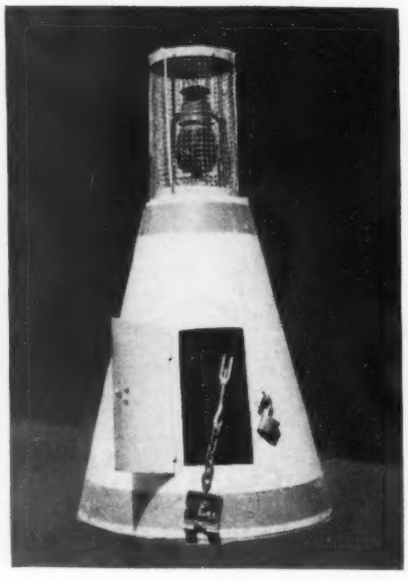
A sliding disconnect at the lower or service side of each transformer keeps the service supply disconnected until the customer's installation has been inspected and a certificate of approval has been issued.

Secondaries of the transformers are delta-connected on the upper terminals of the ten-pole connection block. This permits the use of a two-element meter, conserving space. Meter leads from the connection block terminate in a fixed-terminal meter block, insuring correct connections and ease of installation. Lifting a small sealable, auxiliary cover in the upper compartment cover makes the meter accessible for reading and resetting.

The equipment may be set at the curb or on the wall of a building under construction. Several may be set together for multiple-service connection, since each transformer block will accommodate two 500,000-circ.-mil cables. By using holes for the largest size to be accommodated, knockouts for different sizes of service and load conduit have been avoided. For smaller sizes of conduits, plates with smaller opening are used. Those knockouts not in use are covered with blank plates.

Over-all dimensions of the cabinet, constructed of No. 14 gage galvannealed steel, aluminum finish, are 48 x 24 x 9 in. The two other cabinets accommodate self-contained meters for (1) three-phase, four-wire, 15 to 150-amp., and (2) single-phase, two wire and two-phase, open-wye, three-wire, 15 to 150-amp., two-element network meters. This second and smaller unit is also used for metering outdoor sign service.

Guard for Broken Light Standards



For covering the butt of broken ornamental street lighting standards, to protect the public from either shock or falls, Dallas Power & Light Company uses the red-banded yellow metal guard shown. Made from 16-gage sheet steel, the guard is 31 in. high, 24 in. in diameter at the base and 10 in. in diameter at the top. A short piece of angle iron, slotted to receive a fixture bolt, is attached to the inside roof of the device through a chain and turnbuckle and is used to anchor the guard in place. The lantern that tops the device is inserted in its protective cage from inside the guard and can be reached only through the padlocked door. Where service permits, an electric light is substituted for the lantern.

Wattages Are Being Increased

Right Across the Country with

FLAMENOL*
SMALL DIAMETER BUILDING WIRE
(For Rewiring Existing Raceways)

Building owners are taking advantage of this synthetic-insulated building wire to obtain increased wattages.

Electrical contractors are using it to sell rewiring jobs that they haven't been able to touch before.

Power companies are pleased with the increased load that rewiring with Flamenol puts on their lines.

Typical Installations—Each Providing Increased Illumination

Office buildings in	
Fresno, Cal.	10,000 feet No. 12 Flamenol
Houston, Texas	100,000 feet No. 12 Flamenol
Omaha, Nebr.	4,000 feet No. 10 Flamenol
Lynn, Mass.	2,000 feet No. 12 Flamenol
Store buildings in	
Sheldon, Iowa	1,500 feet No. 14 Flamenol
Hartford, Conn.	1,000 feet No. 10 Flamenol 6,000 feet No. 12 Flamenol
Lowell, Mass.	2,500 feet No. 14 Flamenol
Albany, N. Y.	2,000 feet No. 8 Flamenol 7,000 feet No. 14 Flamenol

Comments of building owners include:

"Well pleased with result."
"Enthusiastic over savings."
"Rewiring done in record time."
"Office space more efficient now."

Flamenol Building Wire is General Electric's contribution to the great rewiring program being launched by the industry. This small diameter building wire enables existing raceways to be rewired inexpensively.

The present wires in conduit can easily be replaced by more Flamenol wires or Flamenol wires of larger capacity. This is done without the mess and expense that would be caused if new raceways were needed.

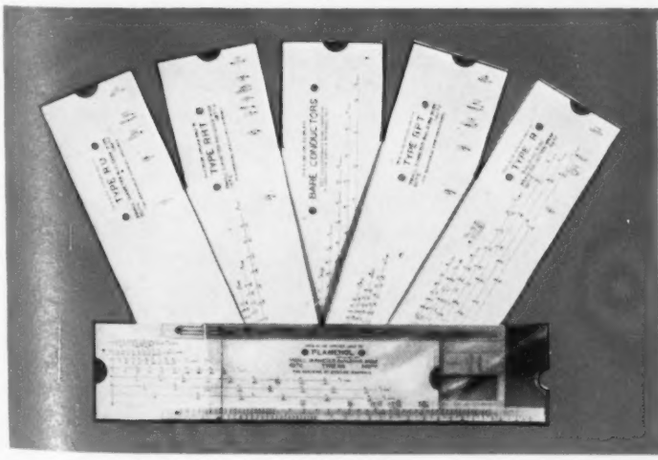
FEATURES OF FLAMENOL

Available in sizes 14 to 4/0 inclusive. Sizes 14 to 8 Flamenol Building Wires have smaller insulation than rubber-covered Type R wires; sizes 6 to 4/0 Flamenol Building Wires have same insulation thickness as Type R wires but absence of over-all braid gives them a smaller diameter.

Insulated with a plasticized polyvinyl chloride compound—no braid necessary. This insulation is superaging, resistant to heat, oils, acids, alkalies, and moisture and has high dielectric and mechanical strength. Same color range as Type R Wires. Approved by the Underwriters'.

For further information about Flamenol Building Wires or for samples, see the nearest G-E Merchandise Distributor or write to Section W-192, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Reg. U.S. Pat. Off.



G-E WIROMETER
For Computing Wiring Problems In Accordance with 1940 N.E.C.

Power salesmen will find the Wirometer helpful in selecting the right wire quickly when making rough layouts. The Wirometer permits quick calculation of conduit fill, current-carrying capacities when three or more wires are run in conduit, etc. Wirometers may be obtained from G-E Merchandise Distributors.

GENERAL ELECTRIC

INDUSTRIAL ENGINEERING

Economy in Industrial Capacitor Application

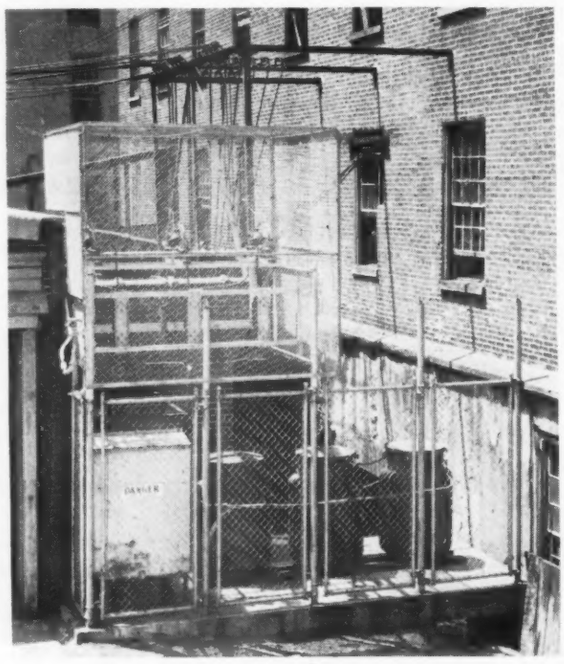
By EUSTACE C. SOARES
Consulting Engineer, New York City

When adding reactive kva. to a plant to improve power factor the problem of whether to add such kva. on the high-voltage or low-voltage side or at individual motors, where it can be switched off with the load, is solved most economically in the majority of cases through a combination of all three applications, if that is possible, as in the following illustration:

Power was supplied to a woolen mill through a 4,160-volt, three-phase, four-wire service to an open delta 87-kva. transformer bank (two 50-kva. units). Metering was on the secondary side and a 20-kva. capacitor was installed in the transformer building at the secondary bus. With a maximum demand of 112 kva. about 95 per cent over-all plant power factor was obtained. Aiding this power factor situation was a 35-hp., 80 per cent P.F. synchronous motor carrying approximately a 9 hp. mechanical load and operating at a leading power factor drawing about 80 per cent of full load current from the line.

The plant was faced with a growing load; it was no longer economical to buy power on the low-tension rate. A new 225-kva. substation, shown in the illustration, was designed to take advantage of the primary power rate.

The new rate required operation at not less than 90 per cent power factor. This was accomplished first by removing the inefficient 35-hp. synchronous motor and replacing it with a 10-hp. induction motor and a 5-kva., 240-volt capacitor. Incidentally, the 35-hp. synchronous motor, having an 80 per cent P.F. rating, found a ready sale for use as a generating unit. A 30-kva., 4,160-volt, three-phase capacitor was placed outdoors in the transformer substation. About 40 hp. of new load was added, so that the new demand became 145 kw. at about 95 per cent P.F. Part of this new load consisted of a 20-hp. motor which was located within 15 ft. of the new distribution center and the 240-volt capacitor, while another part of the load at the end of a feeder had a 5-kva., 240-volt capacitor connected at the machine which was driven by six motors aggregating 14 hp.



CAPACITORS of high and low voltage combined for lowest cost correction in industrial substation

By using the 4,160-volt capacitor it was possible to reduce the investment cost. With the plant as now operating the future policy has been established, as regards correcting for power factor, to add capacitance at 240 volts, directly at the motor equipment and connected such that it is switched on and off with the load. The added capacitors, of course, would not necessarily be placed on all new equipment.

The new transformer substation, including 4,160-volt feeder from the street, transformer pad and fencing, 240-volt distribution panel and building, three-pole gang-operated air-break disconnect, three 75-kva. transformers, outdoor disconnecting type fuses of 50,000 kva. interrupting capacity, 30-kva., 4,160-volt capacitor with oil switch, and all wiring up of distribution feeders to new center, as well as substation wiring, was built complete at a cost of $5,200, including engineering costs.

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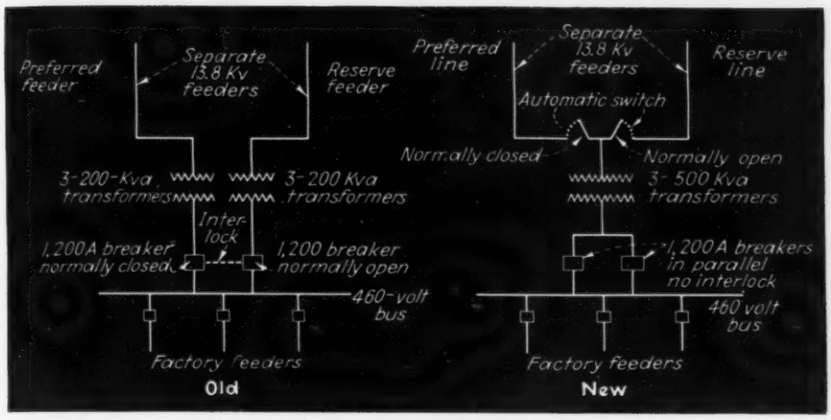
Switches Solve Reliability Problem

When the Western-Austin Company enlarged its Aurora, Ill., factory some months ago, the plant electrical demand doubled. Accordingly, ca-



ONE POWER BANK replaces two in factory substation without loss of reliability. Automatic switches close in reserve line without loss of voltage on preferred feeder. Diagram shows "before and after" arrangement of factory supply

pacity of the factory substation was boosted by replacing the two separately fed 600-kva. transformer banks (one main and one standby) with a single bank of 1,500 kva. capacity. The change was made without sacrifice to reliability by retaining the separate 13.8-kv. feeders and installing automatic air-break switches at the substation to transfer the power bank from preferred to reserve feeder and back, automatically, in the event of line faults.

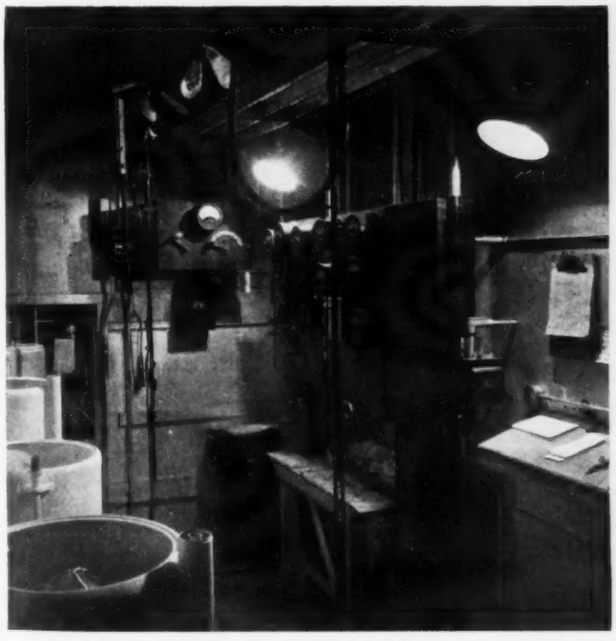
Previous to the change (see diagram) the secondary side of both the main and reserve transformer bank was connected to a 460-volt, three-phase bus at the factory switchboard through mechanically interlocked 1,200-amp. breakers. The interlock prevented both transformer banks from being closed on the 460-volt bus at the same time. But the transfer of the factory load from one bank (and feeder) to the other, for whatever reason, had to be done by manual operation of the breakers and on the secondary side of the power bank.

With the automatic disconnect switches, installed as indicated, the desirable reliability feature of separate supply sources was retained and, at the same time, switching from preferred to reserve feeder was done automatically and on the high-voltage side of the transformer bank.

It was also found that by paralleling the two 1,200-amp. main secondary breakers at the switchboard and removing the interlock the added factory load could be adequately handled by the existing equipment without purchasing a new main breaker of higher carrying capacity.

Motor circuits actuating the automatic switches are energized from potential transformers connected to the line side of the disconnect switches in the preferred and reserve lines. Thus, with loss of voltage on the preferred feeder, voltage of the reserve line is used to open the switch in the faulted line and close in the switch on the reserve line. On the restoration of voltage on the preferred line its switch closes automatically and the switch in the reserve line opens, restoring operation to normal without manual attention.

Fluorescent Lighting for Easier Inspection



BEFORE—Six reflectors, each equipped with a 200-watt daylight incandescent lamp, provided about 50 ft.-candles on the inspection line at Apex Electric & Manufacturing Company of Cleveland. Lamp brightness of these units was high, causing annoying direct and reflected glare: heat radiated by them caused discomfort

AFTER—Six twin-lamp Westinghouse luminaires, each utilizing two 48-in., 40-watt fluorescent lamps, provide 100 ft.-candles. Note the absence of shadows on the product being inspected and the evenness of illumination. Direct and reflected glare has been eliminated and radiant heat is no longer annoying to the workers

NEW ENGINEERING IDEAS

Energize Ground Wire For Airway Lighting

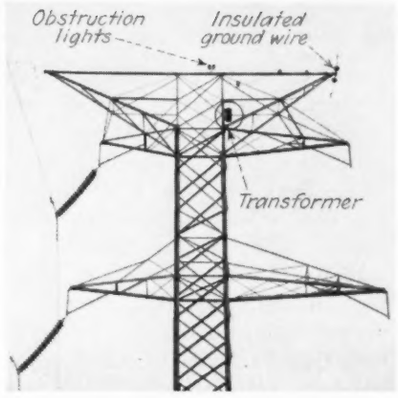
By agreement with the Civil Aeronautics Board, the first ten miles of towers at the north end of Commonwealth Edison Company's new 220-kv. line* from Powerton to Northwest stations are provided with standard red duplex airway obstruction lights. The method of supplying these lights constitutes a departure from conventional practice. On this line, instead of installing a separate distribution circuit for the lights, one of the transmission line ground wires was insulated to serve this purpose.

Each of the 71 towers involved is provided with a small distribution transformer of the CSP type. These transformers are energized by a single-phase 2,160-volt distribution circuit over one of the ½-in. Copperweld ground wires which is insulated from the steel towers. Return path for this circuit is provided by earth and the other non-insulated ground wire. Electrical connections for the lighting circuit are shown in the accompanying diagram.

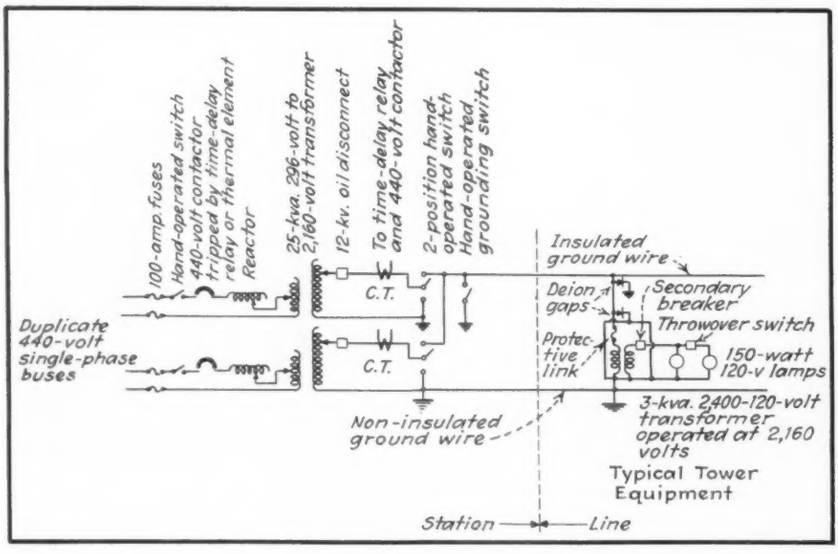
Standard 150-watt, 120-volt lamps are used in the duplex fixtures. These are operated at about 90 per cent of rated voltage to secure long life. A throw-over relay is provided to place the second lamp in service if the first fails.

Duplicate 440-volt supply circuits are provided, each containing a contactor tripped by time-delay relay or thermal element, a series reactor for limiting fault current to a value tolerable to communication circuits paralleling the 220-kv. line and a 25-kva. supply transformer. Each circuit may be connected to the insulated ground wire by means of hand-operated disconnect switches.

* See feature articles "Electrical World," January 25 and February 8, 1941.



OBSTRUCTION lighting equipment installed on double-circuit angle tower
Duplex light supplied by small transformer energized from 2,160-volt circuit on insulated ground wire.

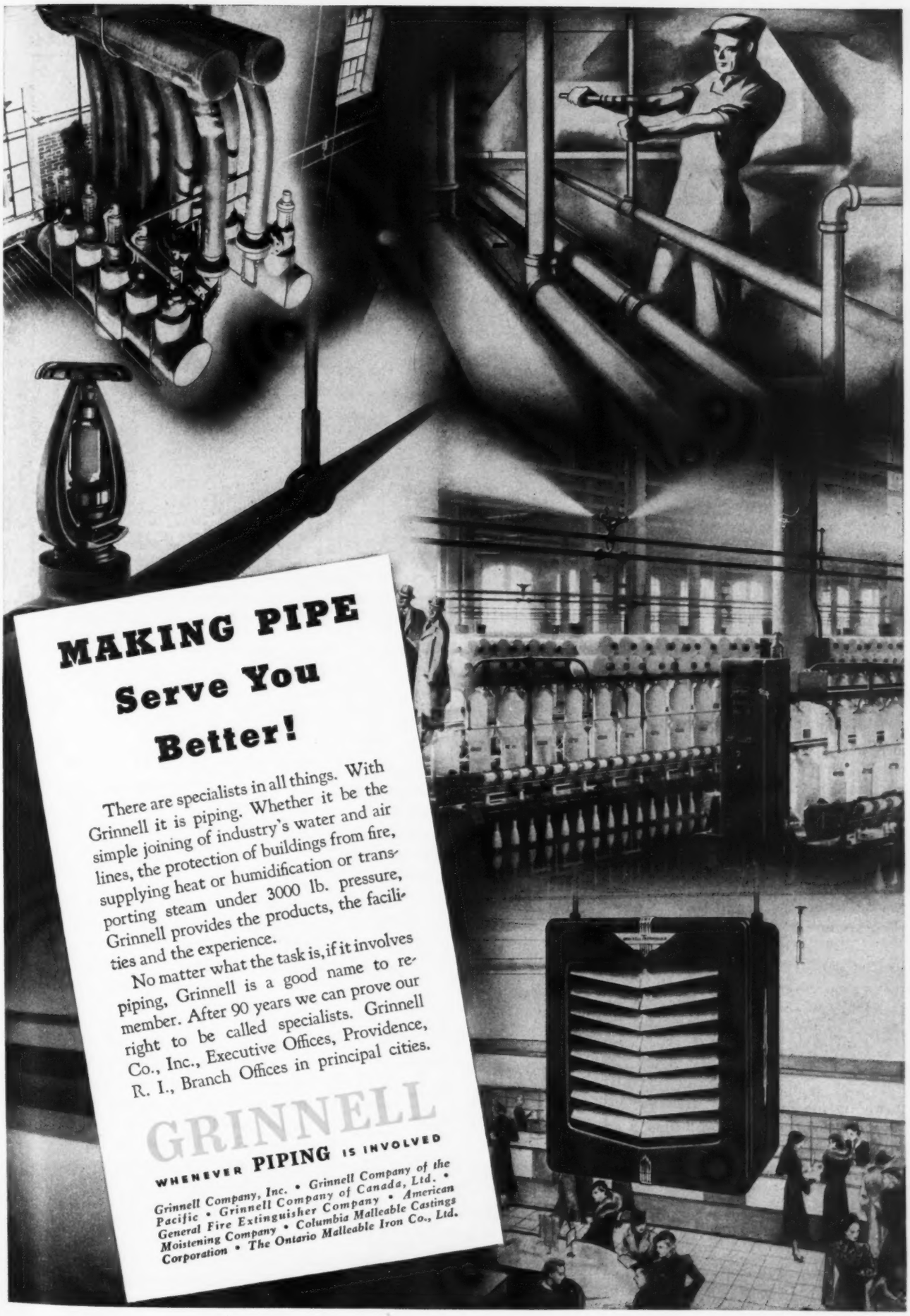


CIRCUIT for obstruction lighting on Powerton-Crawford 220-kv. line shows how transmission ground wire is used to supply 2,400/120-volt transformer serving airway obstruction lights on transmission towers

Because of the limitation in fault current on the lighting circuit rapid clearing of faults was unnecessary. Instead, clearing operations were co-ordinated to minimize circuit interruptions, about as shown in the table.

The lights are switched on and off automatically by photocell control. This photocell energizes the lighting circuit at about 30 ft.-candles and de-energizes the circuit at 60 ft.-candles intensity.

Although not electrically connected to the tower steel, the insulated ground wire still serves to provide lightning protection to the 220-kv. line. A lightning stroke to this wire can discharge to the tower steel and ground through the Deïon gap at the distribution transformer, the Deïon gap on the transformer lead near its point of connection to the ground wire, or over the ground wire in-


MAKING PIPE
Serve You
Better!
There are specialists in all things. With Grinnell it is piping. Whether it be the simple joining of industry's water and air lines, the protection of buildings from fire, supplying heat or humidification or transporting steam under 3000 lb. pressure, Grinnell provides the products, the facilities and the experience.
No matter what the task is, if it involves piping, Grinnell is a good name to remember. After 90 years we can prove our right to be called specialists. Grinnell Co., Inc., Executive Offices, Providence, R. I., Branch Offices in principal cities.
GRINNELL
WHENEVER PIPING IS INVOLVED
Grinnell Company, Inc. • Grinnell Company of the Pacific • Grinnell Company of Canada, Ltd. • General Fire Extinguisher Company • American Moistening Company • Columbia Malleable Castings Corporation • The Ontario Malleable Iron Co., Ltd.

Co-ordination of Clearing Operations

Type of Fault	Disconnected by	Time, Seconds
Lamp circuit (108 volt)	Transformer breaker	4
Distribution transformer winding	Transformer protective link	10
Ground on 2,160-volt circuit	Time-delay relay to open 440-volt contactor	35
Fault on supply to 25-kva. transformer	Thermal trip or fuses	—

sulator. Special small-diameter suspension insulators are used which have a full wave impulse flashover voltage of the order of 90 kv. This provides a margin above the breakdown voltage of the Deïon gap, which in turn is co-ordinated with the transformer insulation.

Insulating one of the two ground wires from the tower is not expected to affect the protection of the line to any noticeable degree.

•

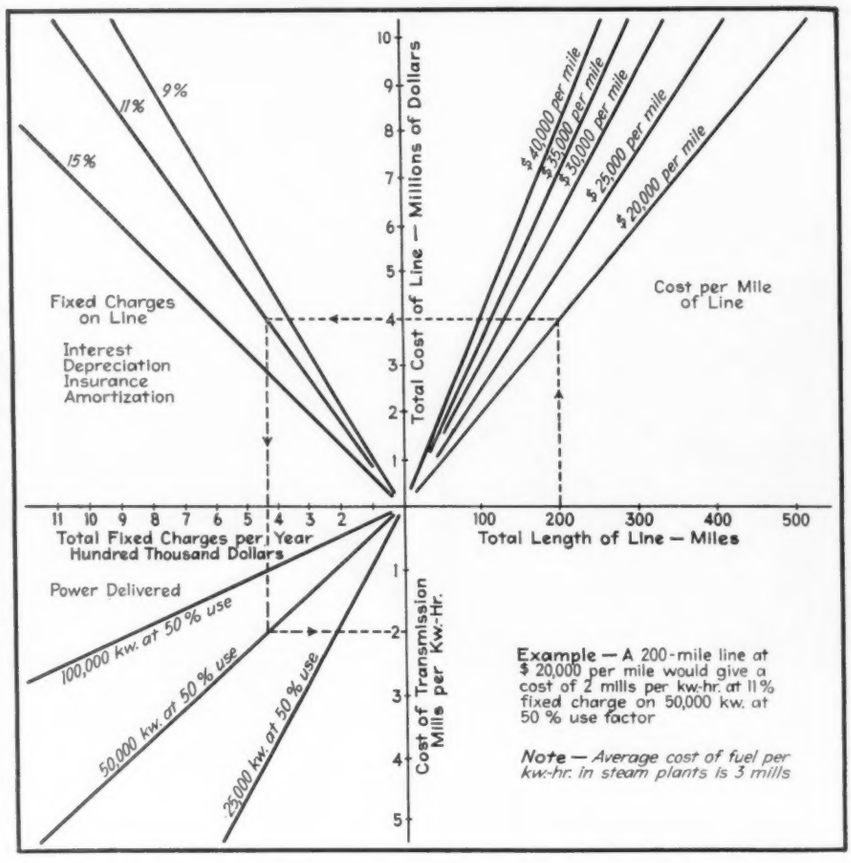
Chemical Treatment For Wood Poles

A preservative treatment for the butts of poles in telephone and power lines erected in remote districts has been developed by the Forest Products Laboratories of the Canadian Department of Mines and Resources, reports *The Engineer* (British). Longitudinal holes are bored in the butts of the poles near the circumference and alternate holes filled with copper sulphate and sodium arsenite. Poles must be treated and set as soon after cutting as possible. The treatment is not effective in dry poles and the bark should be left on the butt up to the ground line.

Evaporation of the moisture from the tops of the poles draws the preservatives up to the sapwood from the holes in the butt. Both chemicals are soluble in water, and as they are drawn up the pole they meet. The resulting chemical reaction forms a new substance — cupric arsenite — which is insoluble in water and an effective preservative against the organisms which attach to the wood. This reaction occurs at the ground line, where the decay is greatest.

The treatment is said to provide protection from decay for several years.

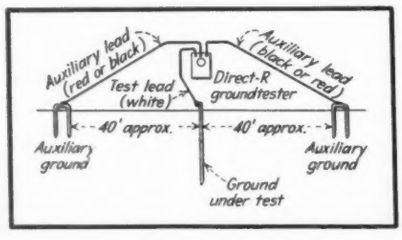
Transmission Cost Figured Graphically


11%
9%
15%
$40,000 per mile
$35,000 per mile
$30,000 per mile
$25,000 per mile
$20,000 per mile
Fixed Charges on Line
Interest
Depreciation
Insurance
Amortization
Total Cost of Line — Millions of Dollars
Cost per Mile of Line
Total Fixed Charges per Year Hundred Thousand Dollars
Total Length of Line — Miles
Power Delivered
100,000 kw. at 50 % use
50,000 kw. at 50 % use
25,000 kw. at 50 % use
Cost of Transmission Mills per Kw.-Hr.
Example — A 200-mile line at $ 20,000 per mile would give a cost of 2 mills per kw-hr. at 11% fixed charge on 50,000 kw. at 50 % use factor
Note — Average cost of fuel per kw-hr. in steam plants is 3 mills

Direct-Reading Ground Tester

With a new self-contained test set for measuring ground resistances, test results are given directly in ohms. It is not intended to be used for fractional ohm readings, but to serve as an easily operated instrument which will accurately indicate whether the resistance to ground is, for example, 10, 15 or 50 ohms.

Only one meter is used in the ground tester, serving first as an ammeter, then as a voltmeter which is calibrated in ohms instead of in volts. The variable resistance is adjusted to cause a 50-milliamp. current to flow through the electrode and the earth. Then, by connecting the meter as a voltmeter, the fall in potential so measured will be directly proportional to the resistance to ground of the electrode under test.

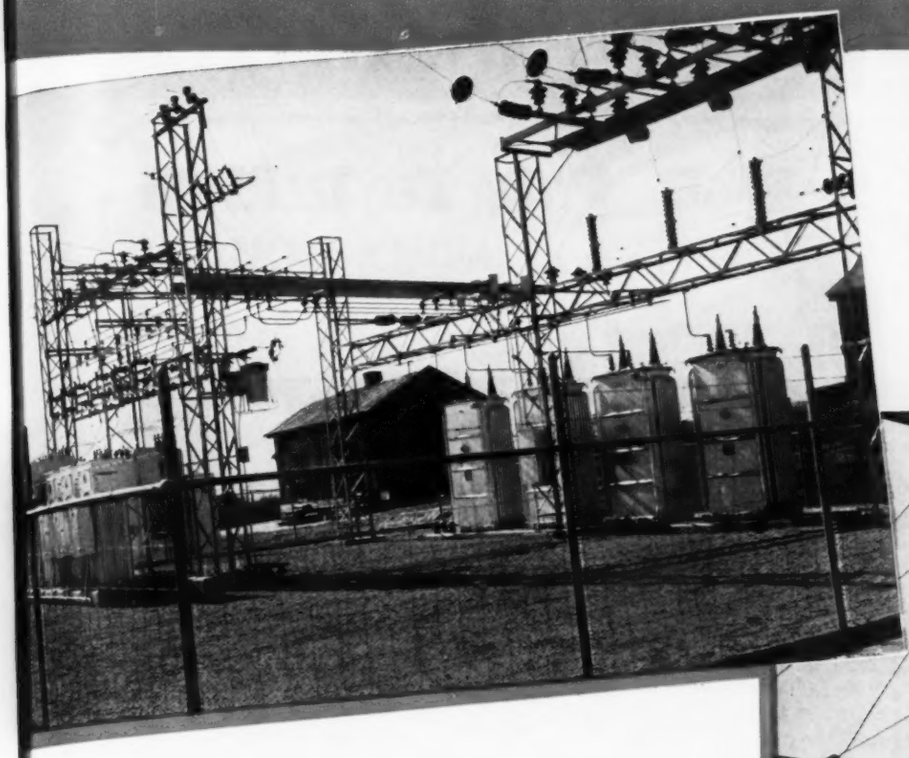


GROUND TESTER for measuring resistances to ground of a grounding electrode features simple operation. Current flowing through the electrodes is adjusted to a fixed value, and direct resistances of the ground being measured are read directly on the single meter.

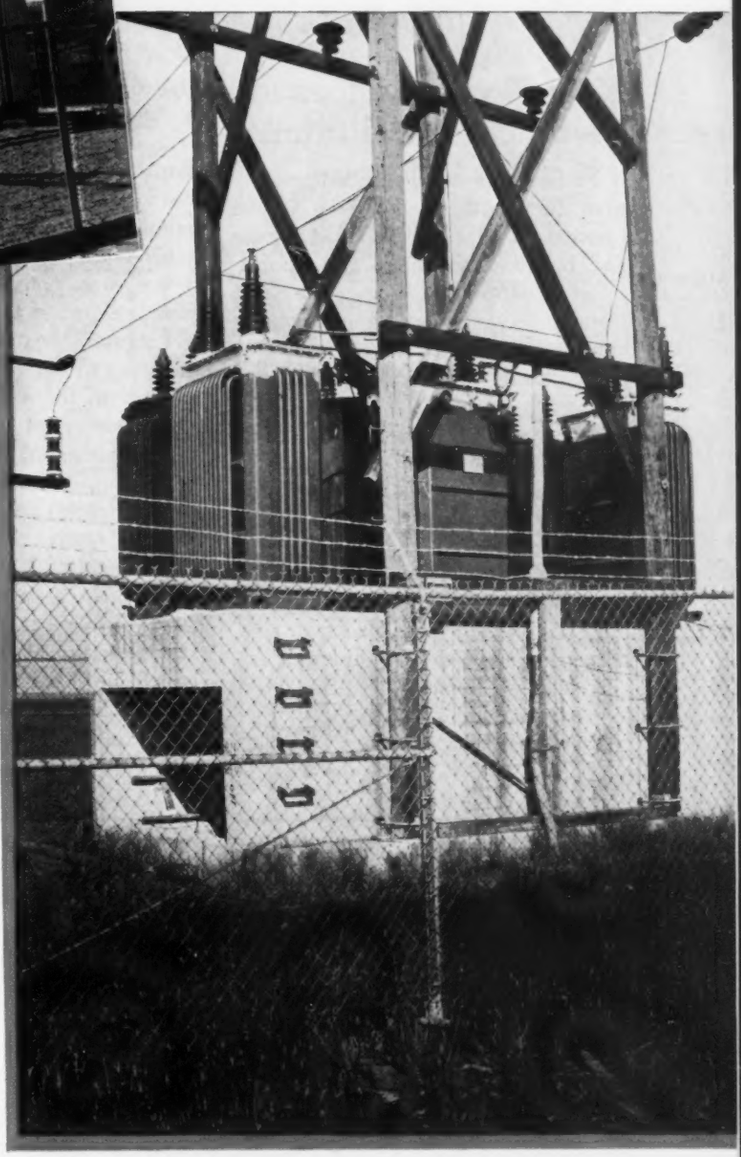
Since the resistance of the voltmeter circuit is extremely high in comparison with the resistance of the auxiliary ground, the actual value of this resistance has negligible effect on the meter reading. The effects of polarization, galvanic action and stray currents are canceled by means of the rotating polarity reversing switch (commutator), which simultaneously reverses both the d.c. potential supplied by the 22½-volt battery and the meter. A.c. stray currents are said not to introduce errors in the readings.

Developed by an engineer of the Rural Electrification Administration's research engineering department, the test set, known as the "Direct-R" ground tester, is manufactured for the Copperweld Steel Company, Glassport, Pa.

WAGNER Distribution Transformers



Promote Continuity of Service



CONTINUOUS, uninterrupted service is a vital necessity in the power industry. Public confidence rests upon the ability of power companies to serve their customers 24 hours each day with absolute dependability.

The transformer is one of the vital links in any power distribution system. If the transformers give trouble, unsatisfactory service results and operating costs go up. The selection of transformers, since it affects both the consumer and power company, is a matter that should receive very careful study.

The actual performance record of Wagner transformers in service is your assurance that Wagner transformers will give years of continuous, uninterrupted service, and be a credit to your system. In all parts of the country Wagner transformers are establishing records for continuity of service.

The installation above is a job in the South. Wagner transformers were selected for this key position. The installation shown at the right is a replacement job. Here it was necessary to increase the capacity of the sub-station and Wagner transformers were the choice.

The engineering and construction features of Wagner transformers are the reasons why more and more companies are selecting Wagner. These features are fully discussed in Bulletins TU-180 (distribution) and TU-181 (power). Write for your copies today.

T40-5

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

LOAD BUILDING

New Plan Finances Electrical Installations

Under a new co-operative financing plan the Consolidated Edison System Companies offer their manufacturing and business customers an opportunity to finance both the purchase and installation of any appliance or equipment operated by electricity or gas on terms up to three years at low finance charges.

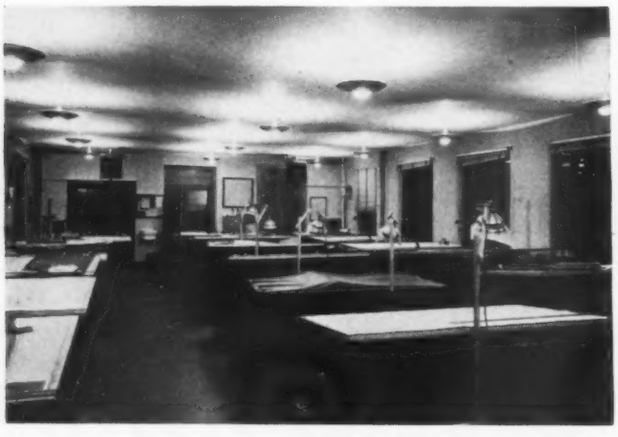
All types of gas and electric equipment are included. Thus, business men and manufacturers contemplating modernization and expansion involving modern lighting systems, elevators, air conditioning, refrigerators, signs, ventilating fans, motors, industrial boilers or furnaces, or anything gas or electrically operated required in a commercial store or factory may use this financing service.

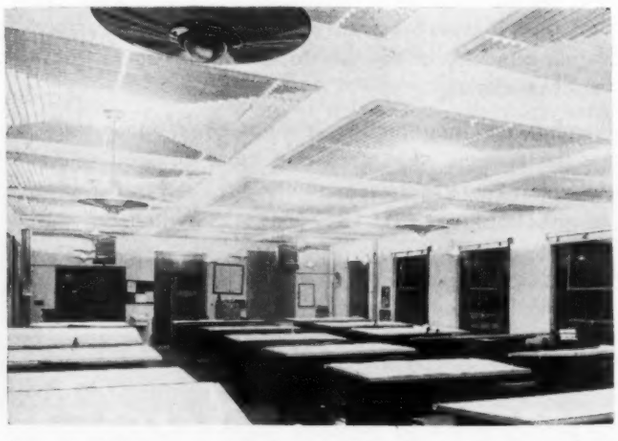
Last June the system companies announced a similar plan which was designed to help business and industry in New York City expand and modernize. It represented the first time that commercial and industrial establishments were enabled to purchase equipment using electricity or gas on a three-year finance plan. The response was gratifying and the new plan is expected to produce even better results because it includes the financing of the installation as well as the cost of the equipment itself.

A commercial customer or industrial customer may present his proposition to any office of the Consolidated Edison System Companies or request a representative to call to discuss the requirements. He will be supplied with a buyer's statement form and in cases involving a proposition of $1,000 or more with a statement of assets and liabilities and income forms. These, when signed, will be passed upon by the utility and the bank and the customer and the seller advised as to the terms and conditions under which the financing will be acceptable.

The essential features of the plan are: (1) That any approved gas or electrical appliance which is used on industrial and commercial establishments, together with the installation cost in connection therewith, is eligible. Installation cost will not be financed separately from the equipment. (2) Any manufacturer, distributor, dealer, contractor, engineer and architect who has a good reputation in the community and who is capable of fulfilling his part of the contract may act as the seller. There is no recourse against the seller. The seller assigns the conditional sale contract to the bank and indorses the buyer's note without recourse. The seller agrees to accept 97 per cent of the net selling price stated in the contract (cash selling price less down payment). The remaining 3 per cent

Three Times the Light at Half More Load





Tops of the drafting tables in the engineering department of the Ohio State Highway Department at Ravenna got only 6 to 8 ft.-candles from fifteen fixtures using 200-watt lamps (left). With 15 No. 207 Silvray luminaires using 300-watt silvered bowl Mazda lamps, installed on a parabolume ceiling, the draftsmen now have an average of 24 to 30 ft.-candles (right). The parabolume ceiling is a product of the Berger Manufacturing Division of the Republic Steel Corporation, Canton, Ohio.

WOULD YOU BELIEVE IT ?

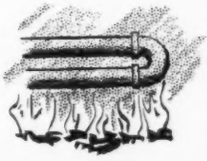
THINGS YOU MAY NOT KNOW

NO HEAT IS WASTED WITH THE HOTPOINT AUTOMATIC ELECTRIC WATER HEATER, FOR THE IMMERSION UNIT HEATS ONLY THE WATER—NOT THE OUTSIDE AIR

FIRST WHITE HOUSE BATH TUB WAS INSTALLED IN 1850 BY PRESIDENT MILLARD FILLMORE, AND IT SERVED THE OFFICIAL FAMILY FOR 35 YEARS

NO HOT WATER!

NEW YORK STATE QUIZ FOUND LACK OF ADEQUATE HOT WATER SERVICE FOURTH IN PEOPLE'S FAVORITE "PET PEEVES"

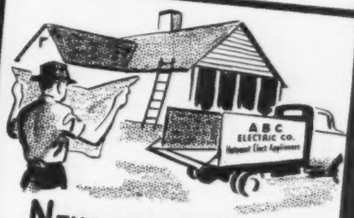


APPROXIMATELY 20% OF FURNACE FUEL SUPPLY IS USED TO HEAT WATER, TESTS SHOW. ELECTRIC WATER HEATING ELIMINATES THE WASTE OF FUEL

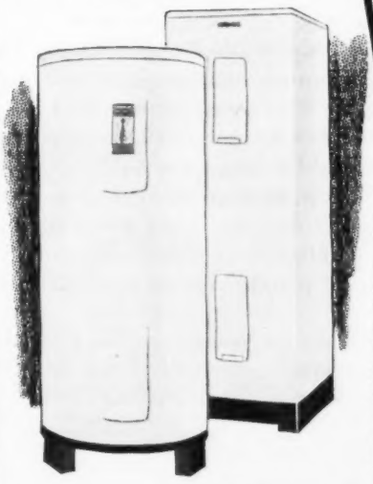
LEAKY HOT WATER TAPS OFTEN ARE DUE TO EXCESSIVELY HOT WATER GENERATED BY INEFFICIENT HOT WATER HEATING SYSTEMS. ELECTRIC HEATING KEEPS A CONSTANT TEMPERATURE OF 145° - 150°

IN THE AVERAGE AMERICAN HOME HOT WATER IS USED APPROXIMATELY EVERY TWENTY MINUTES EACH DAY, ACCORDING TO A SURVEY

ELECTRIC HEATING OF WATER IS SAFEST! NO MATCHES, FLAMES, DANGEROUS FUMES. IT'S "SAFE AS THE ELECTRIC LIGHT YOU READ BY"



NEW HOMES BY THE THOUSANDS - GIGANTIC BUILDING PROGRAM UNDER WAY NOW IN AMERICA MEANS THAT MANY HOMES RIGHT IN YOUR OWN LOCALITY ARE RIPE PROSPECTS FOR HOTPOINT WATER HEATERS



HOTPOINT offers Calrod, the famous efficient, durable and economical Immersion Unit which, immersed directly into water, assures far greater speed and economy in heating. A never-ending supply of hot water, day or night, is assured by the completely automatic Thermosnap Temperature Control. The new home and remodeling market is ripe for sales of Hotpoint Electric Water Heaters. Ask about Hotpoint sales promotion helps. Sell the best-known and most complete line in the Industry. Edison General Electric Appliance Company, Inc., 5618 W. Taylor Street, Chicago, Ill.

AUTOMATIC ELECTRIC **Hotpoint** WATER HEATERS

ELECTRIC RANGES · REFRIGERATORS · WASHERS AND IRONERS
CLOTHES DRYERS · AUTOMATIC DISHWASHERS · ELECTRASINK

Edison General Electric Appliance Company, Inc.
5618 West Taylor Street, Chicago, Illinois

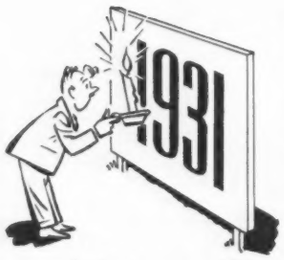
Please send me full information on the complete line of Hotpoint Automatic Electric Water Heaters.

*Name*_____

*Address*_____

*City*_____ *State*_____

WHY 50 FOOTCANDLES?



TEN years ago you could probably count the 50 footcandle installations in this country on the fingers of one hand. Throughout the length and breadth of the land they were few and far between. People felt it was wasting light to spread it around that way. Fifty footcandles? The idea!

Today there are many communities where the lighting industry has had the courage to sell, and customers have had the wisdom to buy lighting systems that provide as much as 50 footcandles. Such installations are still far from becoming common, but they begin to shine out in every lighting field—in stores, factories, offices.

Three important steps have made this possible:

1 *The research which led to the Science of Seeing, proving the need for more light.*

2 *Development of new light sources which make the higher levels of lighting practical, and*

3 *Reduction in the cost of current—and lamps.*

Fortunately for the lighting industry and for the eyes of the nation, all of these developments came along together, a firm foundation for demonstrating the need for better lighting, and the practical tools that make it possible.

Sometimes, however, we are inclined to forget the basic facts of the Science of Seeing on which this new era of Better Light for Better Sight is built. Even the lighting salesmen who today are selling the 50 footcandle jobs are not always conscious of the reasons for recommending such lighting levels.

They will be better salesmen and render their customers a better service if they review occasionally the fundamentals of the Science of Seeing. Toward this end, General Electric plans to publish during 1941 a series of advertisements (of which this is the first) featuring some of the highlights of that Science. Toward this end we suggest an answer to the question. "Why 50 Footcandles?"

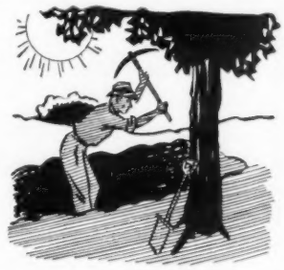
How Many of Your Customers Know These Facts:

Three factors are necessary for the act of seeing: the eye, the object to be seen, and a source of light.

Our eyes developed during thousands of years of outdoor seeing—under daylight levels of lighting and long distance vision. Only within the last few generations have we moved indoors and subjected our eyes to artificial light and difficult visual tasks.

Our ancestors did most of their seeing under 5,000 to 10,000 footcandles in the sunlight and 200 to 1,000 on overcast days or in the shade of a tree.

Today, most people attempt much more critical seeing under light only 1 or 2% of that. The result may be eyestrain, fatigue, nervousness and eventually the impairment of vision.



The human body is a seeing machine.* We see with more than our eyes alone. Our whole nervous-muscular system is affected. In fact, the strain of prolonged seeing under difficult conditions may be more tiring than the hard physical work of digging a ditch.

Are You Dramatizing the Science of Seeing with Such Simple Facts—

THAT it takes 3 times as much light to read a newspaper with the same ease as it does a well printed book?†

THAT good light aids poor eyes even more than normal eyes?

THAT it is estimated we are using our eyes for severe visual tasks about 30% more than was common a generation ago—and many times more than a century ago?

THAT a fourth of our children have defective vision?

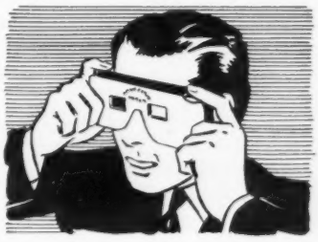
THAT three-fourths of all people over 50 suffer from defective vision?

Many complex laboratory researches have demonstrated that we see faster, more easily, and with less fatigue, the closer we come to outdoor seeing conditions.

*See Chapter VI, "The Science of Seeing" by M. Luckiesh and Frank Moss
†See Chapter V, "The Science of Seeing"

G-E MAZDA LAMPS

Typical of many of today's better fluorescent lighting installations is the better than 75-footcandle illumination in Pugh Brothers' jewelry store in Youngstown, Ohio. Tests show that better light speeds sales, makes merchandise more attractive, and improves employee morale.



In other words, *better light* literally means *better sight.*

Furthermore, the average person, when given the opportunity to select the amount of light under which he can most easily perform a fairly difficult seeing task like reading a newspaper, selects somewhere between 100 and 200-footcandles.

So to the question "Is 50-footcandles of light enough for critical seeing?" science can only answer "No. Generally you need all you can get." But 50-footcandles is a long step in the right direction—and it is easy to get with modern light sources and equipment.

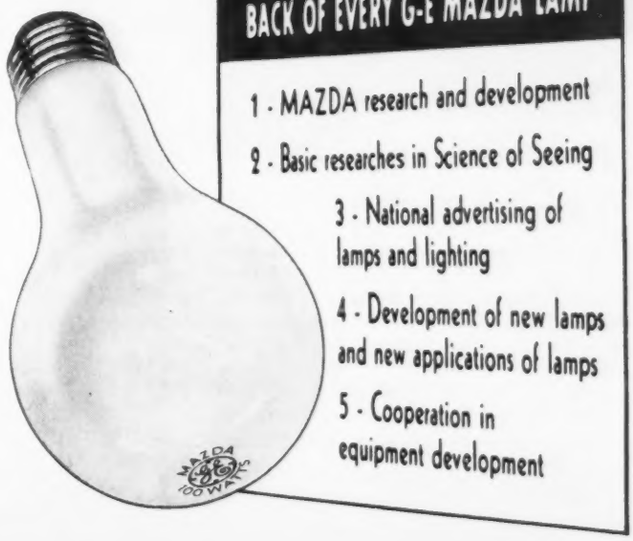
Of course, every lighting job should be considered individually and planned to produce the best results. The lighting engineer equipped with his light meter to measure light accurately, and his visibility meter to determine the visibility of the task, can easily solve any lighting problem and recommend the proper treatment.

Forty-Niners Club Announced

SOME twenty years ago, General Electric welcomed many lighting salesmen to membership in a 10 Footcandle Club. That was considered good lighting back in 1920. But science has revealed new goals. The tempo of modern business demands more of lighting.

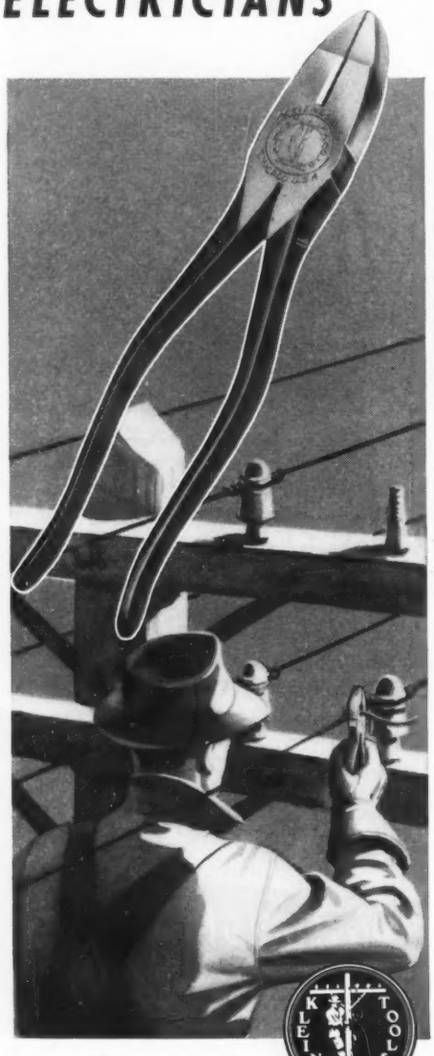
In 1941 this Club is brought up to date as the Forty-Niners Club, and the honor of membership is extended to any salesman who has been primarily responsible for selling an installation of 49-footcandles or more, or to any executive who works under 49-footcandles. The attractive emblem shown at the right will be sent to all members. A brief description of the installation, attested by the sales manager, is all that is necessary for membership. Send it to Secretary, Forty-Niners Club, General Electric Company, Nela Park, Cleveland, Ohio, or consult your G-E Lamp Division for further details.

REMEMBER:


BACK OF EVERY G-E MAZDA LAMP
1 - MAZDA research and development
2 - Basic researches in Science of Seeing
3 - National advertising of lamps and lighting
4 - Development of new lamps and new applications of lamps
5 - Cooperation in equipment development

GENERAL ELECTRIC

KLEIN . . .
STANDARD WITH ELECTRICIANS



"Since 1857"

NO "pretty good" plier is good enough for the man who has to work with them every day. That's why electricians—everywhere—rely on Klein Pliers. They know that each pair must pass an individual test far in excess to any service in the field. They know, too, that every pair is individually fitted, tempered and adjusted—that Klein Pliers have been the standard—"since 1857."

Your copy of the Klein Pocket Tool Guide will be sent on request.

DISTRIBUTED THROUGH JOBBERS

Foreign Distributor:

International Standard Electric Corp., New York

Mathias **KLEIN** & Sons

3200 Belmont Avenue, Chicago, Illinois

will be set aside in the bank in general reserve for defaulted contracts. (3) Any customer using gas or electric service furnished by one of the system companies at the address where the equipment is to be installed and whose credit application is approved by the bank and the utility is eligible under the plan. (4) The finance cost to the buyer is calculated in accordance with the Low-Cost Chart provided by the National City Bank of New York for use under this special plan. (5) The maximum term for payment is 36 months; the amount to be financed is the cost of the equipment including installation; the down payment will vary with circumstances and will be determined in each case.

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Multi-Installation of Contained Units

With the addition this year of 52½ hp. in unit air conditioning to the 40-hp., in units, installed last year, Cherry & Webb Co., largest women's apparel store in Providence, R. I., is demonstrating the practicability of self-contained units, installed in multiple, for department store air conditioning.

In analyzing the different types of air conditioning available to them last year, executives of the store decided upon a trial installation of units because of certain advantages which seemed to be inherent in their design. For one thing, they reasoned that it would be practical to buy their air-conditioning equipment piecemeal, if they elected units, because additions to the system could easily be made any time without disrupting normal business operations, and without extensive redecorations. Likewise, units could easily be moved whenever a rearrangement of sales departments became necessary.

Unit air conditioners require but little selling space, which was already at a premium because of the growing nature of Cherry & Webb's business. They can be installed in odd unused corners or in non-selling space such as locker rooms and stock rooms.

The use of several units, with several points of individual control scattered throughout the store, promised flexibility and economy of operation because certain areas could be cooled independently of the rest of the store. Thus it would not be necessary to start up the whole system to handle the heat load developed by a crowd attending a sale in any one department. Moreover, the use of several units, each with a relatively small motor, would avoid a big boost in the electric power demand rate.

Because of these considerations Cherry & Webb bought two General Electric FD-100 (10-hp.) units and they were installed and operating within fourteen days after the order was placed, without interfering with business, for much of the work was done after store hours. The performance of the units, together with the ease and speed of installation, led to the purchase of two more 10-hp. units the following month. These were installed and operating within ten days after the order had been received.

Two of the units are located on the second floor, serving the millinery and sports wear departments;

SELF-CONTAINED unit air conditioner tucked away between display racks on second floor of Cherry & Webb store. Air is distributed direct from conditioner

SCORES AGAIN in '41

For '41
FRIGIDAIRE DEALERS
Offer America the Hottest Step-Up Line in History

Brilliant new beauty!

A world-famous designer creates for Frigidaire completely new concepts of a refrigerator as a beauty note in the kitchen! Now you have striking new step-ups in styling as well as in features!

Use less current!

The bigger, roomier 1941 Frigidaire "Sixes" have 22% more power to keep food better and freeze ice faster! Yet they *cost less to operate* than any previous comparable models.

More useful than ever!

New food compartments — bigger and roomier! New *Frozen Storage Compartments* up to 74% bigger! Shelves adjustable! Even six cu. ft. model selling for only $117.75* is *fully-fitted*, including Hydrator moist storage and Quickube ice service!

Sensational new values!

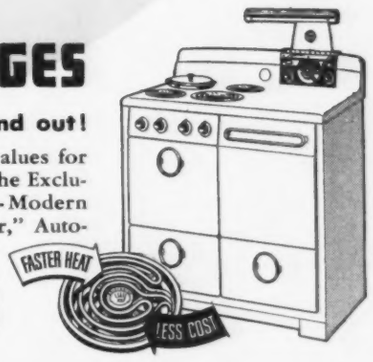
More than a dozen brilliant models to choose from—every one a bargain-priced value. Cold-Wall prices are down as much as $53. Lowest price ever for a standard Frigidaire "Six" with Quickube Trays—only . . . **$112.75***

—And Here are the New
1941 FRIGIDAIRE *Electric* RANGES

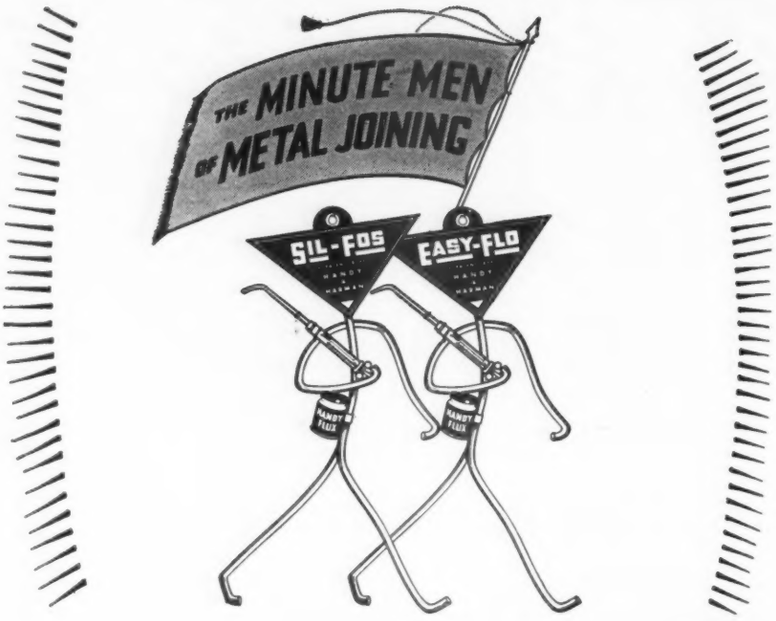
Two Beautiful Series—Eight models, Brilliantly New inside and out!

- New beauty!
- More useful—faster!
- Use less current!
- Sensational new values!

Typical of Frigidaire Electric Range values for 1941 is De Luxe Model B-60. It has the Exclusive New Radiantube Units, Ultra-Modern Fluorescent Lighting, "Cook-Master," Automatic Oven Light, Time Signal, Warming Drawer, Thrifto-Matic Switch, Simpli-Matic Oven Control, plus the dozens of other Frigidaire standard features.



Watch the favorite
Watch Frigidaire
... over 6 million built and sold



ARE YOU LOOKING FOR PRODUCTION BOOSTERS?

On Bus Bar work SIL-FOS brazing eliminates clamps, bolts, drilling or punching and saves metal because of smaller laps required.

Then follow the lead of the thousands who now use SIL-FOS and EASY-FLO on a wide variety of manufacturing and maintenance work. Experience has taught them that these silver brazing alloys **speed up metal joining and consistently produce joints that are sound, strong, high in electrical conductivity and stand up dependably in service.** Low working temperatures, instant penetration, the small amount of alloy needed, little or no finishing—all combine to save labor, heat and materials.

HAVE YOU SEEN THESE ALLOYS WORK?

Try SIL-FOS or EASY-FLO in your own plant **on just one job**—SIL-FOS if it's a non-ferrous job on copper, brass or bronze—EASY-FLO if it's a case of joining iron, steel, stainless steel, Monel, Everdur, Inconel and other ferrous and non-ferrous alloys—and particularly if the job is one of joining dissimilar metals. We'll be glad to cooperate in making this test . . . and to check over your metal joining operations . . . or demonstrate SIL-FOS and EASY-FLO. Write us today for full details. Ask for Bulletins EW-5, 9 and 10.

HANDY & HARMAN 82 FULTON ST., NEW YORK

Agents in Principal Cities. In Canada: HANDY & HARMAN of Canada, Ltd., Toronto

one unit stands behind display racks, the air being distributed direct from the unit. The other is tucked away behind dressing rooms against the wall, with the air distributed through ducts running the length of the floor against the wall. The other two units were installed on the fifth floor, for the children's and young misses' department. Here both conditioners are located at the end of the floor behind display cases, with ceiling ducts running the length of the floor along column lines.

Later three more 10-hp. units and three 7½-hp. units were required. Three of the units were used on the street floor. Only the air-conditioning sections of these units, each located on a stand over the display racks, are located in this area. The condensing unit sections (being separable in the G. E. design) were installed in locker and storage spaces down in the basement. An FD-100 (10-hp.) unit and FD-70 (7½ hp.) unit, each with ductwork running along the wall, are located on one side of the room. A single 10-hp. unit, also with ductwork, serves the other side of the floor. Conditioning sections are mounted on pipe stands so they can be moved if the department is rearranged.

Improving Service To Range Users

The problem of getting range customers to notify the utility company in advance of moving in order that wiring arrangements may be made in the new location is being met by the Southern California Edison Company with a series of recipe cards sent monthly to this class of consumers.

On the back of each card is a reminder of the desirability of notifying the utility before moving or building a new home, for the sake of convenience and the assistance which the power company provides in installing wiring for a range or water heater. The cards are distributed with *Electrical Times*, which accompanies the monthly service statement.

The series was inaugurated with a two-fold card containing menu and recipes for a holiday dinner. It is planned to use single cards in the future. The company anticipates that this policy will help stop load losses due to range owners moving to an unwired home.

which are hereby agreed to

AILERS MORE THAN DOUBLE THOSE STEP IN KELVINATOR'S LONG-RANGE SUCCESS . . .

Check These Kelvinator Franchise Advantages Against Any Other

1 EXCLUSIVE EXTRAS . . . No other refrigerator offers the exclusive new Magic Shelf—the Stainless Steel Cold-Ban—the Glass-enclosed Cold-mist Freshener cooled by coils within the walls of the refrigerator. And the 1941 Kelvinator Ranges offer new, exclusive features at the lowest prices in history.

2 STEP-UP PLAN . . . A *logical* step-up plan based on the actual retail *value* of each added feature. The *higher* priced models, in both refrigerators and ranges, are easy to sell.

3 NEW LOW PRICES . . . Last year Kelvinator's new price policy revolutionized the industry. This year, step number two in our long-range program reduces refrigerator and range prices even farther, and greater values have been built into every model in the line.

4 HIGH UNIT SALES . . . Last year the average of 80 per cent of all Kelvinator retailers' sales was $160 —which we believe sets an industry record. With this year's amazing step-up plan Kelvinator retailers will again sell an overwhelmingly big per cent of higher-priced refrigerators and ranges.

5 SIZE . . . One of Kelvinator's most important *extras* is size. Six cubic-foot refrigerators are now six and three-quarter cubic feet—and eights are eight and three-quarter cubic feet—thanks to Kelvinator's new cabinet construction. And all ranges have big, *oversize* ovens.

6 SELECTIVE MARKETS . . . Kelvinator's 1940 policies, carried forward into 1941, have earned for Kelvinator the reputation of putting into actual practice—"a market for every dealer—a dealer for every market".

7 FEWER MODELS . . . By concentrating on the models people really want, Kelvinator has reduced its refrigerator line to *eight* models—its range line to three—and thus reduced the retailer's investment to a minimum and simplified his selling problem.

8 SERVICE-FREE . . . The Polarsphere Sealed Unit has set a record for reliable performance. Of the hundreds of thousands of Kelvinator refrigerators sold last year, less than one-half of one per cent were returned to the factory for service.

9 REPLACEMENT SALES . . . The new and radically different 1941 Kelvinator Moist-Master with its glass shelves and Cold-mist Freshener, offers the most powerful replacement incentive in years. And every 1941 Kelvinator is a *brand new* model. Not one is a relabeled carry-over from 1940.

10 ADVERTISING AND PROMOTION . . . The biggest campaign in Kelvinator's history is already under way with four-color magazine advertising—key city newspaper and transcribed radio spot announcements—new style billboard posters and complete cooperative advertising materials. Selling and product literature is printed in *full-colors*.

11 STOCKING . . . Kelvinator's Redisco Plan for 1941 provides the most flexible and liberal method of stocking refrigerators and ranges you have ever been offered.

12 PLANNED DISTRIBUTION AND MANUFACTURING . . . A long-range program developed by a "retail-minded" organization to help retailers build an increasingly profitable business.

Kelvinator Division, NASH-KELVINATOR CORPORATION, *Detroit, Michigan*

Get More — Get KELVINATOR

NEW EQUIPMENT

Ground Tester

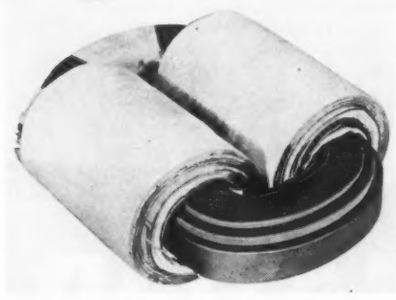
With this new direct-reading ground resistance tester, test results may be read directly in ohms. Only one meter is used in the self-contained instrument, serving first as an ammeter and then as a voltmeter calibrated in ohms, instead of volts. Device uses an adaptation of the fall in potential method to measure the resistance to ground of an electrode. It cannot be used for fractional ohm readings.

"Direct-R" ground tester; weight, 9½ lb.; complete with 22½-volt battery, auxiliary ground electrodes and leads. **Copperweld Steel Co.**, Glassport, Pa.

•

Transformer

Wound core and round coils distinguish a new distribution transformer. Tests conducted on the unit are said to show improved regulation at all power factors because of decreased reactance, resistance and impedance; a better ratio of losses—both copper and total losses—lower exciting current, because of the elimination of the air gap in the core; uniformly high impulse strength and an unusually high short-time over-load capacity.



Wound core and round coils of new "Round Wound" transformer; in production on single-phase 60-cycle ratings of 1½ to 25 kva., 7,620 volts and below. **Line Material Co.**, Milwaukee, Wis.

•

Thermostat

"Posi-trol" thermostat. **General Thermostat Corp.**, 389 East 165th St., New York, N. Y.

New type of thermostat for electrically heated appliances depends upon linear expansion of brass for its operation.

•

Demand Meter

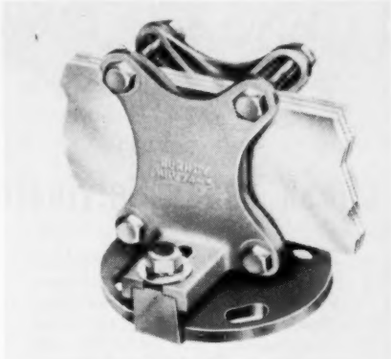
For watt-hour meter applications where mounting space is limited, or where an existing socket installation makes no provision for a separate demand meter, this new watt-hour demand meter combines two standard meter elements in a single unit, with a single set of terminals. Sangamo Type "J" watt-hour meter and Lincoln Type "WD" watt demand meter are used. Meters mount on standard watt-hour meter sockets.

Type "JWS" watt-hour-demand meter; in single-phase two- and three-wire construction. **Sangamo Electric Co., Lincoln Meter Div.**, Springfield, Ill.

BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Bus Clamp

As an aid in simplifying the installation of flat bar bus structures, this company has brought out a bus support clamp that supports the flat bar vertically; the same clamp may be used to hold one or more flat bars. If the supporting insulator is slightly out of line with other insulators, a "slide track" in the clamp permits compensation so that the flat bar itself remains straight and true. Both clamping plates are fastened to the base so that any short-circuit stresses are divided over both parts.



Type "HHV" bus support clamps; aluminum bronze; for any number of bars of 1½ to 12 in. width. **Burndy Engineering Co., Inc.**, 459 East 133rd St., New York, N. Y.

•

Adapter Units

"Fluralamp" adaptors; sizes accommodate one 15- or 20-watt lamp or two 20-watt lamps; for use on 110-120-volt, 60-cycle a.c. **Eagle Electric Mfg. Co.**, Brooklyn, N. Y.

Adaptor units for fluorescent lamps may be screwed into existing sockets. Swivel plugs permit adjustment to assure that light will focus on horizontal plane. Reflectors are open at the bottom, finished inside in white baked enamel.

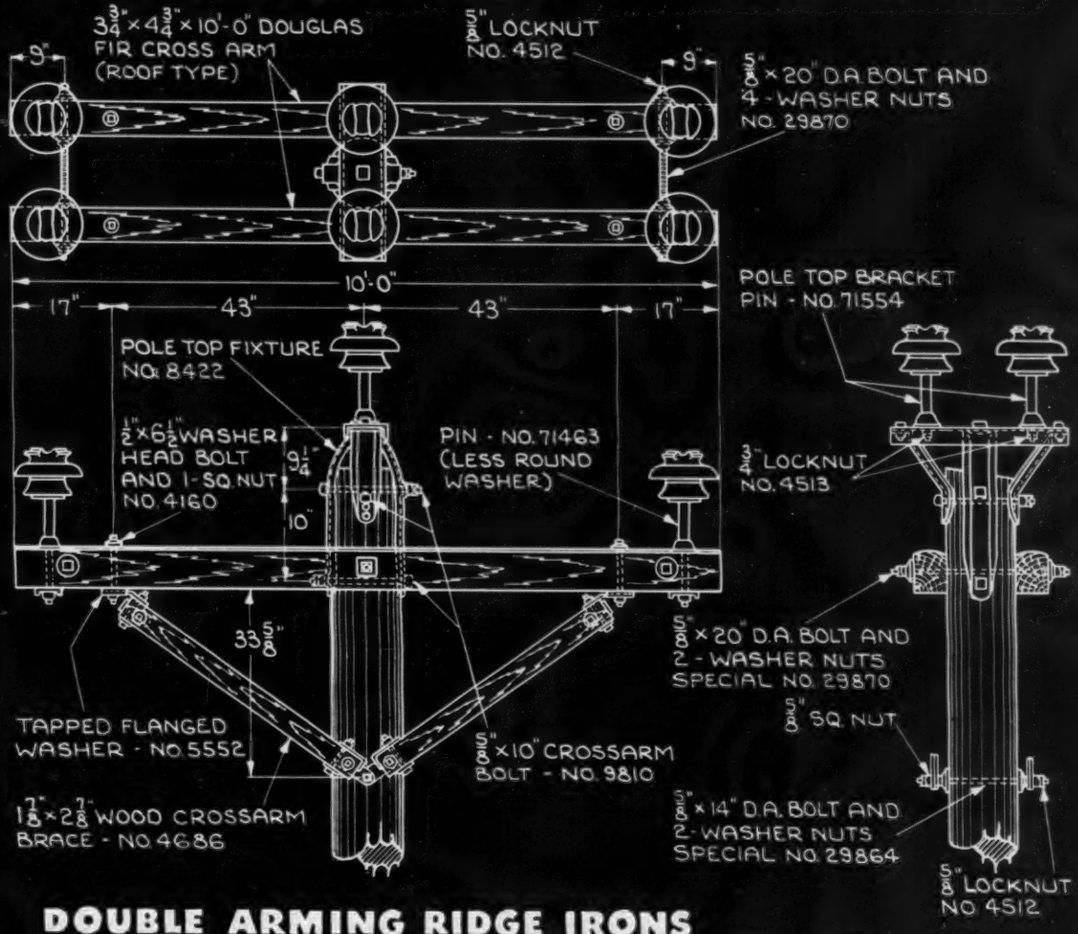
•

Timing Control

"Model 52" timer; timing range limits are from 1/30th sec. to 120 sec.; 110 or 220 volts. **Weltronic Corp.**, Detroit, Mich.

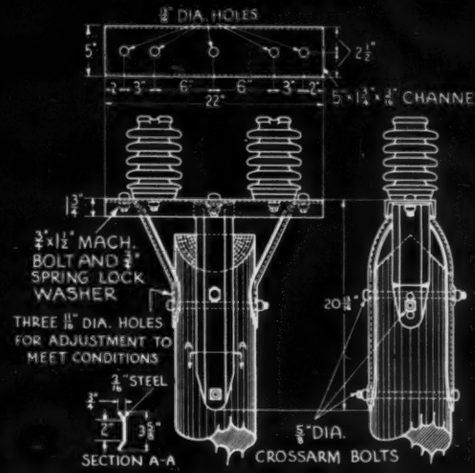
Electronic timer for general-purpose recycling or sequencing operations features a selector knob that allows the operator to

TRANSMISSION STRUCTURES


3¾"×4¼"×10'-0" DOUGLAS FIR CROSS ARM (ROOF TYPE)
5/8" DIA. LOCKNUT NO. 4512
9"
9"
5/8" DIA. × 20" D.A. BOLT AND 4 - WASHER NUTS NO. 29870
10'-0"
17"
43"
43"
17"
POLE TOP BRACKET PIN - NO. 71554
POLE TOP FIXTURE NO. 8422
½"×6½" WASHER HEAD BOLT AND 1-SQ. NUT NO. 4160
9¼"
10"
PIN - NO. 71463 (LESS ROUND WASHER)
4¾" LOCKNUT NO. 4513
33 5/8"
5/8" DIA. × 20" D.A. BOLT AND 2 - WASHER NUTS SPECIAL NO. 29870
5/8" SQ. NUT
TAPPED FLANGED WASHER - NO. 5552
5/8" × 10" CROSSARM BOLT - NO. 9810
1⅞"×2⅞" WOOD CROSSARM BRACE - NO. 4686
5/8" DIA. × 14" D.A. BOLT AND 2-WASHER NUTS SPECIAL NO. 29864
5/8" LOCKNUT NO. 4512

DOUBLE ARMING RIDGE IRONS

HOT GALVANIZED

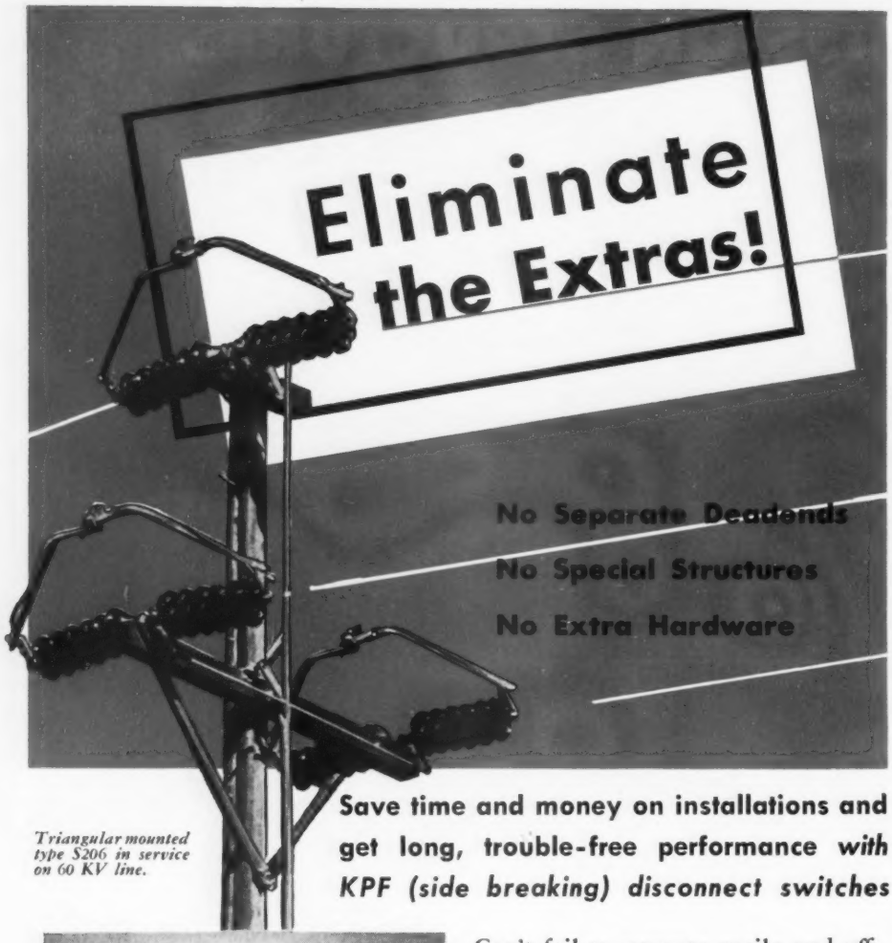


Sept. 1st - We agree with specifications on the Valley Line proposal
L. Earlie

DOUBLE ARMING TYPE RIDGE IRONS—FOR POST OR PIN INSULATORS

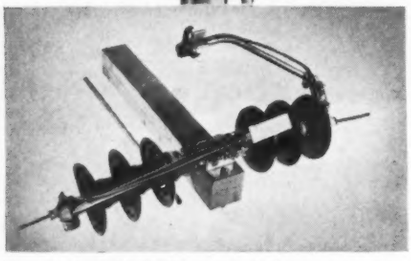
Stock No.		Dimensions — Inches					Approx. Shpg. Wt., Lbs., 100 Pcs.			
							Standard		With Block	
Standard	With Block	Pole Bolt Spacing	Diam. of Pole	Diam. of Mtg. Bolts	Pin or Post Spacing (Center to Center)	Size Pin Hole	No.	Wt.	No.	Wt.
6320	5920	8	5½ to 6¾	5/8	12	1¼	6320	2800	5920	3230
6321	5921	8	6¾ to 8	5/8	12	1¼	6321	2800	5921	3230
6322	5922	8	8 to 8½	5/8	12	1¼	6322	2800	5922	3230
8420	7420	10	5½ to 6¾	5/8	12	1¼	8420	2800	7420	3230
8421	7421	10	6¾ to 8	5/8	12	1¼	8421	2800	7421	3230
8422	7422	10	8 to 8½	5/8	12	1¼	8422	2800	7422	3230

HUBBARD HARDWARE!"



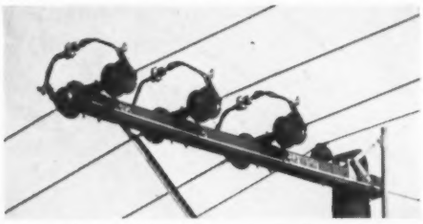
Triangular mounted type S206 in service on 60 KV line.

Save time and money on installations and get long, trouble-free performance *with* KPF *(side breaking) disconnect switches*



Close up view of KPF Type S switch in open position. Note the simplicity of design—the side opening break

Can't fail to operate easily and efficiently under all conditions because of the utter simplicity of the design. Conductor is secured to terminal on the switch insulator—no separate deadends required. Switch operates by rotation of one of the insulator strings which is controlled by a push pull inter-phase rod moving parallel with the cross-arm. This action is positive and trouble-free—never affected by even the most extreme warpage of the cross-arm.



Type "S" switch horizontally mounted on alley arm

Since the break of the switch is at right angles to the line of the conductor—giving a side opening break—they are inherently superior in the breaking of charging or load currents. This is just one of many distinct advantages to be gained by the use of KPF Disconnecting Switches.

Contacts in slightly open position. Blade and clip is constructed of heavy copper and have electro-deposited silver contact surfaces for long life and cool operation. Flexible mounting keeps them from binding and sticking.

Contacts in closed position. These are standard design for all KPF switches. The special full floating, self-releasing, contacts maintain good contact under all conditions of line sag.

WRITE TODAY FOR MORE COMPLETE INFORMATION

Ask for Catalog No. 109 which gives complete technical data and is fully illustrated. There's no obligation, of course.

K P F ELECTRIC CO. 859 HOWARD ST., SAN FRANCISCO, CALIF.

set the timer by "dialing" for the desired time. Timer is available with maintaining circuit that permits timer to be initiated by momentary touch on pilot device. Otherwise, pilot device must be held closed until timing has been terminated.

•

Searchlight

Particularly adapted for use in protective lighting systems now being installed by industrial concerns to prevent night sabotage, this new searchlight is equipped for pilot-house or hand control and comes with either a low or high pedestal. With pilot-house control, searchlight can be mounted atop a guard house or lookout tower and controlled from within the house with the aid of a hand lever. Silvered-glass parabolic reflector is supplemented with a spherical auxiliary reflector in front of the lamp that builds up beam intensity.

Type "S-5", 18-in., 1,000/1,500-watt incandescent searchlight. **General Electric Co.**, Schenectady, N. Y.

•

Recycling Control

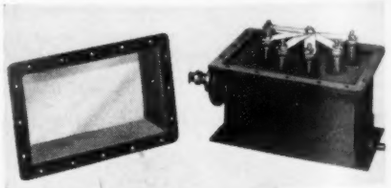
"28" register; for voltages to 250, a.c. **The Permutit Co.**, 330 West 42nd St., New York, N. Y.

New type of recycling control for attachment on water meters used for initiation of automatic processes is so constructed that when a predetermined quantity of water has passed through the meter, a contact will be made which will initiate the automatic cycle, after which the meter control resets itself and is automatically ready to measure the predetermined quantity of water before the next automatic cycle is started. Mercury switches are used throughout; there are no electrical current carrying parts on the dial.

•

Capacitors

Carrier-current coupling capacitor and two capacitors for carrier-current traps are recent additions to this company's line. Low-voltage coupling capacitor is filled with "Dykanol C" and designed with low stress, and an internal construction of low inductance. One of the capacitors for the carrier-current traps is of the fixed capacity



"C-1003", carrier-current coupling capacitor, two sizes, capacities to 0.075 mfd. and voltages to 15,000; "C-1001" and "C-1002" capacitors for carrier-current traps. **Comell-Dubilier Electric Corp.**, South Plainfield, N. J.

type while the other is adjustable over a wide range. These are oil-filled mica dielectric units in steel cases. High-voltage wet-process porcelain bushings are provided for terminals.

•

Fluorescent Developments

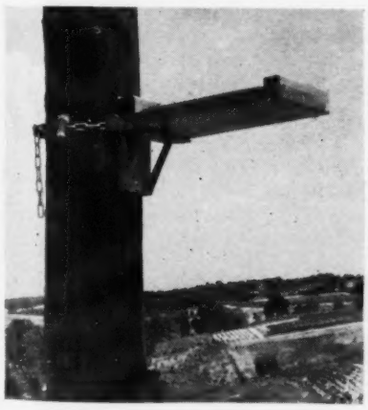
Three new Mazda F lamps; open-end industrial fixture "2-FP-100"; direct or diffuser type industrial fixture "2-FPR-100"; semi-direct commercial fixture "CL-160". **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

Three new fluorescent lamps announced by this company's Lamp Division are the daylight-color 100-watt lamp, 14-watt lamp also in daylight and the 15-watt lamp in soft white. Both industrial fixtures accommodate two of the 60-in., 100-watt white or daylight fluorescent lamps and are equipped with two-lamp ballasts for high power factor. The commercial fixture uses four 40-watt, 48-in. fluorescent lamps, white or daylight or combination of both colors. Side panels are curved "Monax" glass, while bottom panels may be equipped with louvers, clear or decorated ribbed glass. Lamp starters are of the glow-switch types; current-limiting devices have built-in capacitors.

•

Pole Platform

Readily attached to iron, concrete or wood poles, this utility platform has been designed to combine dependable strength and safety with a minimum of weight. Plat-



Utility platform; in 24- or 30-in. length; weight, 22 and 23 lb., respectively. **James R. Kearney Corp.**, St. Louis, Mo.

forms are given an "end of board" proof-test of 750 lb. before being shipped; breakdown is said to exceed 1,700 lb. at end of platform.

•

Flow Meter

"Linameter"; in different combinations of indicating, recording and integrating features; may be equipped with pressure and temperature elements to record on same chart with flow. **Cochrane Corp.**, Philadelphia, Pa.

Area-type flow meter is adapted to measurement of fuel oil, ammonia, hot tar, acids, foodstuffs and other fluids with similar characteristics of viscosity, corrosiveness and solubility. Distinguishing features include omission of U-tubes, mercury and pressure connecting lines, uniformly graduated indicator and chart scales. Transmitter unit, an integral part of the pipe line, employs a weighted disk positioned in a tapered throat by velocity of flow. This position is transmitted electrically to the recorder at a remote location.

Temperature Indicator

Portable, self-contained instrument for thermocouple temperature measurements, for checking thermocouples, or for measuring small e.m.f.s., is said to provide increased accuracy through having only a small portion of the range calibrated on a continuously adjustable slidewire. Remainder of the range, adjustable in fixed steps, is on a dial switch of ten resistors. Only additional accessories required with instrument are thermocouple and ice bath for reference-junction.

"8667" temperature indicator; range from 0 to 111 millivolts, with limit of error of plus or minus 0.1 millivolt. **Leeds & Northrup Co.**, Philadelphia, Pa.

•

Insulation

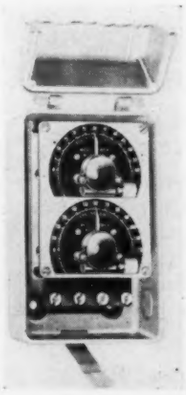
Varnished Fiberglas; in rolls and tapes; standard widths, up to 36 in., thicknesses, 0.005 to 0.012 in., black or yellow. **Irvington Varnish & Insulator Co.**, Irvington, N. J.

Glass cloth, impregnated and coated with heat-resisting varnishes, is now available from this firm for use as insulation by manufacturers of electric motors, generators and similar equipment. Varnish is said to increase cloth's resistance to abrasion, impact and overall mechanical strength.

•

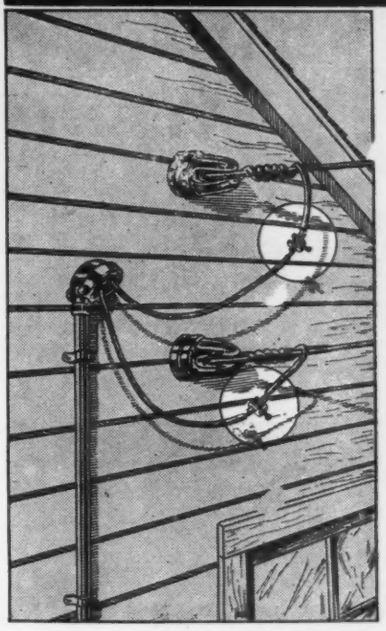
Double Timer

Adapted to industrial applications requiring an adjustable and rapidly repeating time cycle, this automatic double reset timer consists of two of the company's reset timer mechanisms mounted on a control panel and controlling common electrical circuits. Furnishing a 10-sec. impulse every 90 sec. for signalling or heating control is described as a typical application. Operation is continuous and follows the sequence determined by the settings of the timers until the external control switch is opened.



Automatic double reset timer; time ranges for each timer, 15, 30, 60 and 120 sec. maximum; for 110 or 220 volts, 50 or 60 cycles; capacity, 10 amp. at 110 volts, 60 cycles. **The R. W. Cramer Co., Inc.**, Centerbrook, Conn.

modernize
YOUR DISTRIBUTION PRACTICE—



RELIABLE SERVICE ENTRANCE CONNECTOR

The Service Entrance Connector — first developed by Reliable Electric—now saves the Industry thousands of dollars annually.

Made with a yoke that tends to spring slightly when tightened which locks the threads and eliminates the possibility of shaking loose.

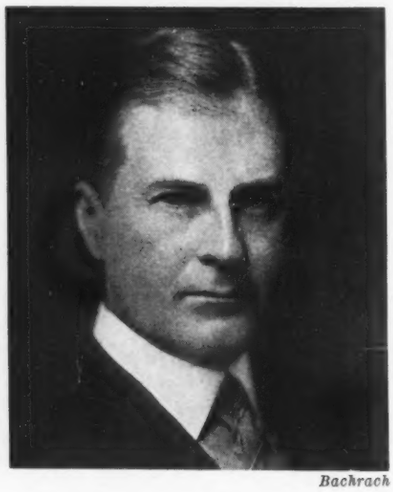
Made also in solid body type

Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS

NEWS ABOUT PEOPLE

W. W. Bodine Heads United Gas Improvement

William W. Bodine, who was recently elected president of the United Gas Improvement Company, was born in Philadelphia in 1887 and was educated at Harvard University and the University of Pennsylvania Law School.



Bachrach

He has been with the United Gas Improvement Co. since 1919, having entered its employ on his return from service overseas. In 1925 he was elected a vice-president and in 1934 became executive vice-president. In 1932 he was elected a director of the company to fill the vacancy caused by the death of his father, Samuel T. Bodine, president of the company from 1912 to 1926.

Mr. Bodine is also a director of Philadelphia Electric Co., Delaware Electric Power Co., Connecticut Light & Power Co. and other U.G.I. System companies.

•

▶ JAMES F. TOWERS, executive vice-president of Ford, Bacon & Davis, engineers, New York, has been appointed by E. R. Stettinius, Jr., as assistant director in charge of administration of the division of priorities, of the Office of Production Management in Washington. During Mr. Towers' absence on national defense work, his duties with Ford, Bacon & Davis will be assumed by W. E. Reynolds, vice-president, and H. E. Whitaker, chief engineer.

•

Westinghouse Promotes Four District Managers

Election of four Westinghouse executives to the rank of vice-president has been announced. They are Bonnell W. Clark of New York, now president of the Westinghouse Electric Supply Co.; R. A. McCarty of Philadelphia, manager of the steam division; Frank D. Newbury of Pittsburgh, manager of the emergency products division; and A. C. Streamer, of Pittsburgh, general manager of the East Pittsburgh division. All the new vice-presidents have been identified with Westinghouse for many years.

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▶ TOM MCDONOUGH, illuminating engineer for the Central Arizona Light & Power Co., Phoenix, has been appointed Arizona representative for the Illuminating Engineering Society.

▶ FRANK A. TRACY, formerly assistant manager of the Sierra Pacific Power Co., is now manager. Mr. Tracy's association with Sierra Pacific is comparatively recent. Immediately prior to joining the utility he was for three years personnel director of Stone & Webster Co., New York.

▶ R. E. ZIMMERMAN, vice-president of the United States Steel Corp., was recently elected president of the American Standards Association. He succeeds Edmund A. Prentis of the firm of Spencer, White & Prentis, who has served as president of the association for the past two years.

Alabama Power Elects Johnson Vice-President

Thomas D. Johnson, who has been connected with the Alabama Power Co., new industries division, for a number of years, has been elected a vice-president of the company.

A native of Ozark, Ala., Mr. Johnson was graduated from the University of Alabama in 1916 and joined the power company soon thereafter. His service was interrupted during the World War. He has been actively engaged in the company's new industries work since 1922.

"The members of the board felt," said T. W. Martin, president, "that Tom Johnson had earned executive position in the company by reason of his many contributions to its growth and progress through the years and the

success he has had on so many occasions in bringing Alabama and its opportunities to the attention of those both within and without the state who were seeking industrial locations."

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▶ WILLIAM C. YATES, since 1937 manager of the control and renewal parts division of General Electric Co.'s industrial department, has been ap-

Buried in marshy ground below salt tide-water level; in corrosive cinder and refuse back fill; in acid soaked soil in industrial centers; under the heaviest traffic — there are hundreds of millions of feet of Orangeburg Standard Conduit in service — literally "a line of conduit" from coast to coast.

The service records of these installations — many thirty years old, some forty — provide positive proof of our claims for Orangeburg's complete cable protection. And when you add complete cable protection to Orangeburg's long life and lower installation costs, you have the reason why thousands of distribution engineers in this nation-wide "network" have long used and still specify Orangeburg.

Sales Agent — Distributors

Graybar Electric Co., Inc.

General Electric Supply Corp.

MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVE., NEW YORK CITY

ORANGEBURG

NOCRETE for installation without concrete encasement

STANDARD for installation with concrete encasement

pointed an assistant manager of the industrial department. Mr. Yates will continue to have charge of the industrial control and renewal parts division. Mr. Yates entered the employ of the General Electric Co. in the testing department in 1898. In 1937 he became manager of the control and renewal parts division in the industrial department.

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Stone & Webster Changes

A. B. Williams, assistant engineering manager of the Stone & Webster Engineering Corp., Boston, has been appointed consulting engineer in the organization; W. F. Ryan, mechanical engineer, has been made assistant chief mechanical engineer, and R. R. Wisner, electrical engineer, has been named assistant chief electrical engineer. F. E. Hertel, structural engineer, becomes assistant chief structural engineer.

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▶ A. J. LYNN, chief accountant for the Kentucky Public Service Commission since July, 1936, has resigned to devote his full time to a public accounting business he heads in Louisville.

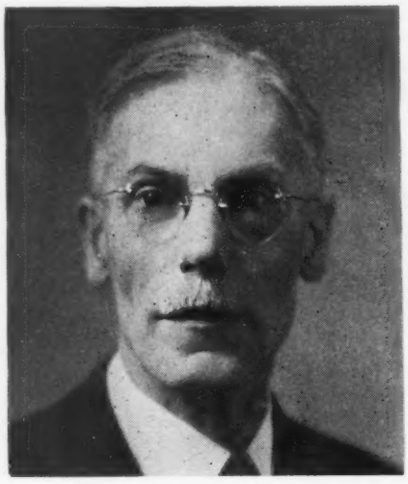
▶ W. M. WADE, formerly superintendent of the Phenix City district electric and gas properties of the Alabama Power Co., has been appointed assistant superintendent of the southern division of the company. E. K. LEARY, who has been connected with the Alabama Power Co. since 1920, has been appointed superintendent of the Phenix City district, to succeed Mr. Wade.

▶ FRANK B. CLIFFE, an assistant comptroller of the General Electric Co. at Schenectady, has left for Washington to serve with the National Defense Advisory Commission. Mr. Cliffe's connection with the commission will be for an indefinite period. Since entering the General Electric Co. in 1920 some of his duties have included the design and supervision of operation of employee benefit plans, service as an instructor and special lecturer in the company's business training course for new employees, actuarial responsibility for company's group life and pension plans and supervision of the company's contribution and information returns under all federal and state social security legislation. Mr. Cliffe by invitation has assisted the joint legislative committees and governors of various states in drafting unemployment compensation bills. He is a member of the business advisory committee to the Social Security Board.

Canadian Westinghouse Elects Vice-Presidents

Announcement has been made of the election of C. H. Mitchell and E. M. Coles as vice-presidents of the Canadian Westinghouse Company. Both Mr. Mitchell and Mr. Coles have seen long service with Westinghouse.

Mr. Mitchell joined the Canadian Westinghouse Co. in 1906. He was promoted to the position of assistant manager of works in 1919, and manager of works in 1939. A keen student of mod-



C. H. Mitchell

ern production methods, Mr. Mitchell directs the company's vast wartime schedules.

Mr. Coles has been in charge of the company's patent department since 1928. For the past year he has held the position of assistant to the president. Mr. Coles joined Westinghouse in 1926 as design engineer. At one time he was assistant professor of electrical engineering at the University of British Columbia.

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▶ J. A. KRUG, formerly chief power engineer for the Tennessee Valley Authority, has been appointed manager of power for the authority.

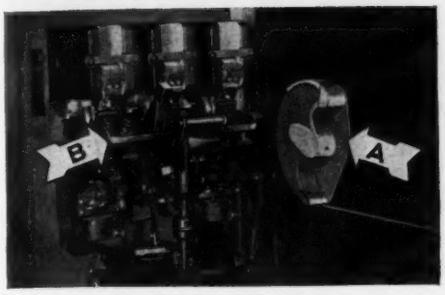
▶ L. E. OSBORNE, manager of manufacturing and engineering for the Westinghouse merchandising division, has been granted a leave of absence to join the staff of the Defense Commission in Washington. Mr. Osborne, a veteran of more than 30 years' experience with Westinghouse, will be assigned to the staff of the Defense Commission's Office of Production Management. His acceptance of the Defense Commission post is in response to a request by William S. Knudsen, Director General of the Office of Production Management, to the Westinghouse company for a man with a wide manufacturing experience. To fill this request, the company surveyed its personnel and suggested Mr. Osborne. His selection has been approved by the Office of Production Management. JOHN H. ASHBAUGH, engineering manager at the East Springfield works, was appointed assistant manager of manufacturing nd engineering for the division.

▶ FREDERICK J. GRIFFITHS has retired as executive vice-president of the Copperweld Steel Co. and active head of the company's steel division at Warren, Ohio. Mr. Griffiths will continue as a director of the company and will act as consultant to President S. E. Bramer.

▶ F. A. MITCHELL, vice-president and general manager of the Virginia Public Service Co., Alexandria, since 1937, has been made head of the company's operations in the Newport News, Va., area, succeeding N. E. Drexler, formerly vice-president, who resigned to become president of the Tidewater Power Co., Wilmington, N. C. Prior to his connection with Virginia Public Service Co., Mr. Mitchell was vice-president and general manager of the Eastern Shore Public Service Co. at Salisbury, Md.

▶ B. C. WOODSON has been appointed safety director on the properties of the Iowa Electric Light & Power Co., Cedar Rapids and Iowa City Railway and the Northwestern Light & Power Co. Mr. Woodson has been with the company more than twelve years, having been in the electric meter department at Cedar Rapids during this entire period. The establishment of a safety department headed by Mr. Woodson comes as a result of more than two years of study by him of the accident experience of the company and the application of corrective measures as employed by other utilities.

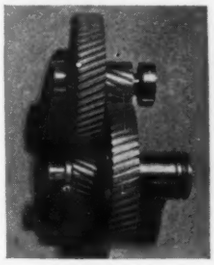
▶ HAROLD W. CLAPP of Melbourne, Australia, was included in the Australian list of New Year Honors as Knight of the British Empire. Sir Harold was born in Australia and came to the United States early in 1902 when he became associated with the General Electric Co. in Schenectady and New York. During his service with that company he was actively engaged in some of the large electrifications carried out at that time. He joined the Southern Pacific Co. in 1908 as assistant chief electrical engineer. Subsequently he became general superintendent and later general manager of the Columbus (Ohio) Railway, Power & Light Co. In 1920 he returned to Australia as chairman of the Victorian Railways Commission. Quite recently he retired from this position to become chairman of the Aircraft Production Commission in Melbourne.



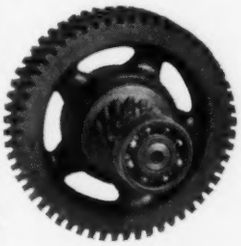
Costly assembled part replaced with one piece molded CELORON unit

The hand closing cam "A" on this feeder circuit breaker is now a one piece molded CELORON unit. It replaces an expensive assembly of metal and insulation. There is nothing in it to get out of order—short—or break. It's an excellent example of how C-D research can help a manufacturer effect measurable production economies and at the same time build greater customer satisfaction through improved product performance.

Food Grinders — wind generators—automobile motors—Textile Machines — now operate smoothly and QUIETLY



When C-D designed the CELORON SPOKE type of molded plastic silent gear it greatly widened the effective use of non-metallic gears. The SPOKE increases by about 50% the fundamental ability of CELORON —to absorb shocks and vibration. The result — quieter operation and longer life at considerably heavier loads and higher speeds.



Materials and Parts handled quickly and without damage

These tough, strong, DIAMOND FIBRE Boxes will not scratch or mar plastic or metal parts. They are designed to stack without resting on the box contents, and may be stacked on a metal dolly for moving around. Extremely light in weight, they reduce to a minimum the handling of useless weight. They do not splinter so reduce injury hazards to workmen.

Standard sizes are immediately available from Bridgeport, Pennsylvania. Special sizes and designs can be quickly made up. Completely illustrated in catalog HW 12.

PEAK PERFORMANCE LIFE

may be lengthened if

C-D RESEARCH DESIGNS

THE ELECTRICAL INSULATION

There are nine distinct types of C-D electrical insulating materials. Of each of these there are on the average seven grades. Each is also made in three standard forms of different standard sizes. Then, too, there are special shapes and parts fabricated to specification. By multiplying, we deduct, the layman has one chance in 7,000 to select the appropriate insulating material for a specific problem.

Chemical Resistance Tests being made on C-D Products

Here's specific help!

C-D's new booklet "What Material?" will help you over the first hurdle by enabling you to pick the one electrical insulating material best suited to your problem based on two known requirements. From that point our Research Laboratory will work with your designers and engineers to develop a type of insulating material in the right form to meet your problem.

The booklet "What Material?" also gives complete data on standard sizes, colors, finishes of DILECTO phenol fibre; DIAMOND Vulcanized Fibre; MICABOND mica products and VULCOID. We suggest you order sufficient to give one to each of your draftsmen, designers, engineers and buyers. Ask for bulletin GF-12.

CONTINENTAL-DIAMOND FIBRE CO., NEWARK, DEL.

C-D Products

DILECTO—A laminated plastic possessing unusual electrical insulating, mechanical and moisture resistance properties.

DIAMOND vulcanized **FIBRE**—A tough, hard, bone-like material of high dielectric and great mechanical strength.

CELORON SILENT GEARS—Absorb vibration, reduce noise, save wear and tear on machines and men.

VULCOID—A laminated resinous fibre combining to a high degree the desirable properties of laminated phenolic and vulcanized fibre.

MICABOND—Mica in its most usable form—sheets, tubes, segments, rings, punched and formed parts.

CELORON—A molded phenolic fabric base plastic of exceptional mechanical strength, attractive appearance, light weight and great stability.

The SPOON that is
Solid Steel
in the Solar Plexus
The one spot where fighters can't take it is the solar plexus—the one spot where a spoon or shovel must take it is the shank and where the blade joins it. The blade, shank and socket of Sturd-E Solid Shank Spoons are forged all in one piece from a solid bar of steel—no welds, seams or pieced together joints. This is the strongest construction known to shovel makers. To add yet more utility, the heavy 13-gauge blade is heat treated. For longer service life and greater value, specify Sturd-E Spoons made by The American Fork & Hoe Company, Cleveland, Ohio.
STURD E TOOLS
a TRUE TEMPER PRODUCT
Western pattern Sturd-E Heavy Duty Spoon with solid steel shank. Blade, shank and socket forged in one piece from a solid bar of steel. 13-gauge blade, heat treated with XX grade hickory or ash handle, sanded and waxed, in lengths from 6 ft. to 12 ft.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

OBITUARY

► DAVID F. HAYES, vice-president and production manager of the Bridgeport (Conn.) Switch Co., died January 6 at his home in Waterbury, Conn. Mr. Hayes was 53 years of age and a native of Waterbury.

► CHARLES R. HIGSON, who rose from a substation operator to superintendent of distribution for the Utah Power & Light system during his 28 years of service, died December 18 at his home in Salt Lake City. He was 57 years old. Mr. Higson, since January, 1940, had been consulting engineer, having given up his superintendency because of poor health.

► WALTER D. LEONARD, western division manager of the Wisconsin Gas & Electric Co., at Fort Atkinson, died suddenly, from a heart attack, on December 3 at the age of 55. Previous to his employment by the Wisconsin Gas & Electric Co. in 1927 Mr. Leonard served as manager of the municipal plant at Fort Atkinson. He was stricken shortly after he had registered in a hotel at Miami, Fla., where he had gone to recuperate.

► JOSIAH W. BUZZELL of Summit, N. J., who retired in 1938 as vice-president of the Stone & Webster Engineering Corp., New York, died January 11 in Sebring, Fla. He was born in Brattleboro, Vt., 67 years ago. A graduate of the Worcester, Mass., Polytechnic Institute, Mr. Buzzell was with the J. G. White Engineering Corp. of New York before joining Stone & Webster in 1918.

► PIERCE J. KENT, retired electrical division head in charge of L Street and Edgar stations of the Boston Edison Co., and an early chairman of the New England System Operators Club, died recently at Boston. Mr. Kent was a pioneer in the electrical operating field, entering the service of the old Boston Electric Light Co. before its absorption by Boston Edison, and rising from the ranks to the post of chief system operator. He was widely known in the northeastern power industry.

► RICHARD E. SMITH, executive assistant, Southern California Edison Co., died on December 8. Mr. Smith was well known as the arranger of Pacific Coast Electrical Association convention programs and Los Angeles Electric Club affairs. In 1915 he started as a lighting sales engineer for Pacific Light & Power Corp. in Los Angeles, and shortly afterward was appointed sales manager of Mt. Whitney Power & Electric Co. in the San Joaquin valley. He was in Tulare when that company was merged with Southern California Edison Co. in 1917. In 1919 he was transferred to the Edison general office in Los Angeles and in 1922 made advertising manager. A new position, that of executive assistant, was created for him in 1932.

► CARL H. HOGE, an assistant engineer for the Puget Sound Power & Light Co., Seattle, died in that city on January 14, in his fifty-sixth year. Mr. Hoge was graduated from the University of Illinois in 1909 and during that year went to Seattle, joining the staff of the old Seattle Electric Co. He had been with the company since that time through its change of name to Puget Sound Power & Light Co. He was active in the affairs of the American Institute of Electrical Engineers and the Northwest Electric Light and Power Association.

► LESTER W. PARSONS, general manager of the Chilean Electric Co., an affiliate of the Electric Bond & Share Co., died in Santiago January 9, after a heart attack. He was 52 years old. Mr. Parsons had been an executive of Latin-American companies affiliated with the Electric Bond & Share Co. for many years.

► HARRY W. HALE, 50, sales manager of the Fall River Electric Light Co., died at his home in Somerset, Mass., January 1, after a short illness. He was born in England, coming to this country as a young man. Before his connection with the Fall River company began, about ten years ago, he was employed by the Narragansett Electric Co. at Providence, R. I.

► JAMES O. MURRAY, manufacturer's agent in New England for the Weston Electrical Instrument Co., Newark, N. J., died January 18 at his home in Winchester, Mass., at the age of 49. Mr. Murray was born in Plainfield, N. J., and was a graduate of Princeton University.

► LEO A. PHILLIPS, who had spent 50 years in the electrical industry, died recently in New Orleans, where he had made his home following retirement from the position of chief engineer of the Federal Water Corp. of New York last April. Mr. Phillips was at one time connected with the General Electric Co., Westinghouse Electric & Manufacturing Co. and Allis-Chalmers Manufacturing Co. He was among those receiving a "Pioneer" Certificate award by virtue of his half century of devoted service to the electrical industry. He was a fellow of the American Institute of Electrical Engineers.

Learn a lesson from a ship story about Fiberglas* Electrical Insulation

LISTEN TO THIS: a brand-new 800 K.W. generator was recently installed in an overworked English liner. Its coils were wound with Class A insulation. The slot insulation was Class B.

And what happened?

The insulation failed on its first trip . . . leaving the ship's pumps, fans, blowers, and other electrical equipment without current.

So, the generator was rewound by Electrical Engineers, Inc. This up-to-the-minute organization uses Fiberglas insulation *exclusively* for Class B requirements. They used Fiberglas on the generator, and since then . . .

. . . the ship has been in grueling, continuous service, with *no failure* of its main power plant.

Moral: If you have a tough job for electrical insulation — use Fiberglas. Experience in scores of U. S. industries proves that proper application of Fiberglas enables *other* types of equipment to stand up where they previously failed in service with other insulations.

And, Mister, that saves money!

How About Fiberglas For Normal Service?

Suppose your generators, motors, or other electrical equipment have been working under entirely normal conditions. No overloads. No excessively high temperatures . . . no acids, oils, dusts, or dampness. Can Fiberglas help *you?*

You bet it can! Take motors—

Chances are . . . your motors will be working more and *more* hours now that all industry is moving ahead on faster schedules. Therefore, downtime on your equipment due to motor failure is an increasing danger.

You can obtain the maximum safety factor, as other companies have, by insulating your standard-size motors with Fiberglas!

There's another way Fiberglas may help you, for today top-ranking motor manufacturers also make Fiberglas-insulated motors that are smaller than present Class A insulated motors of the same H.P.

Yet these Fiberglas-insulated units operate safely at approved higher temperatures, and . . . *still have a substantially higher safety factor!* Cost? A little more in some instances—no more in others.

Wouldn't it be wise, then, for you to protect yourself against downtime losses, by protecting your equipment with Fiberglas? Do that. Specify Fiberglas Electrical Insulation. *Owens-Corning Fiberglas Corporation, Toledo, O. In Canada: Fiberglas Canada, Ltd., Oshawa, Ont.*

OWENS-CORNING

FIBERGLAS*

*T. M. Reg. U. S. Pat. Off.

TO ELECTRICAL ENGINEERS: Not only for motors and generators, as described above, but for all types of electrical equipment—Engineers have found *and used* the superior qualities of Fiberglas for electrical insulation. Why not you? You can get Fiberglas in all standard forms. Write to us today.

MANUFACTURING - MARKETS

Westinghouse Shows Sharp Profit Gain

Net profit of Westinghouse Electric & Manufacturing Co. for the year ended December 31, 1940, was $18,985,428 after charges and federal income taxes, equal to $7.10 a share on combined 79,974 shares of 7 per cent preferred and 2,592,155 shares of common, as compared with net profit of $13,854,365, or $5.18 a share, on combined shares in 1939.

Orders booked in December amounted to $49,149,370 and for 1940 a total of $400,477,724, the largest in the history of the company. This compares with $214,239,044 booked in 1939.

Sales billed in December were $22,276,781, against $16,037,096 in December, 1939, and for 1940 sales billed totaled $239,431,447, as against $176,858,811 in 1939.

Unfilled orders on December 31, last, amounted to $223,685,737, compared with $70,821,960 at the end of 1939.

Directors declared a dividend of $1 a share on the common and preferred stocks, payable March 5 to stockholders of record February 14.

A 48-hour week has been adopted at the Sharon, Pa., works in an effort to speed up production of transformers needed in the defense program. Employees working more than 40 hours a week will be paid time and a half for the extra hours.

•

Strikers Return to Work at Phelps Dodge Plant

The strike of 1,000 employees of Phelps Dodge Copper Products Corp., which tied up production at the Elizabeth, N. J., plant, returned to work this week. The strikers ratified an agreement reached between company executives and CIO representatives. The strike, which affected $230,000,000 in national defense orders, was called a "lawless act" by President Wylie Brown of Phelps Dodge, intended to force the company to violate the Wagner Act by voiding its present contract with an independent union and accepting CIO demands for a new employee election.

•

Report 1940 Gains for Laundry Units

Further gains in sales of washers and ironers during 1941 were predicted by Joseph R. Bohnen, executive secretary-treasurer of the American Washer and Ironer Manufacturers Association, in announcing sales figures for the year just ended.

Washer-ironer sales totaled $123,377,437 during 1940, compared with $109,215,030 in 1939.

Household washer sales in 1940 totaled 1,522,666 units at an average retail price of $72.88, compared with 1,433,256 in 1939, at $70.13. The increase in unit sales was 8.3 per cent. Ironer sales in 1940 totaled 175,466 at an average of $58.24 each, an increase in units of 38 per cent over the 127,093 sold in 1939 at an average of $68.46.

December was the second highest month in the industry's history for both washer and ironer sales. During the month 92,474 were washers sold to domestic users, an increase of 19.6 per cent over 1939. Ironer sales totaled 23,191 during the month, an advance of 95.6 per cent over the 11,854 sold in December, 1939.

•

Shifts Board Action

Copperweld Steel Co., to bring action on dividends closer to record and payment dates, has decided to have its board take action on the fifteenth of the month preceding the other dates. The next action will be taken on February 14, because the fifteenth is a Saturday.

Refrigerator Sales Set Record in 1940

A new high for electric refrigerator sales was established in 1940, with the thirteen reporting companies showing sales substantially ahead of 1939, according to the report issued by the National Electrical Manufacturers Association. World Sales during the year amounted to 2,676,435 units, compared with 1,980,195 units in 1939. Domestic sales gains were responsible for the new mark in total sales because total foreign sales were nearly 10 per cent less than the 1939 total. Domestic sales during the year amounted to 2,528,566 units, compared with 1,819,641 units in 1939, while foreign sales (including Canadian), totaled 147,869 units, compared with 160,554 units in 1939.

In December domestic sales amounted to 107,176 units, compared with 86,011 units in December, 1939. World sales in December totaled 115,748 units, compared with 92,955 units in the corresponding month of 1939.

•

Release Power Generator From Strike Bound Plant

The conciliation service arranged last week, in response to an appeal from the Army, for release from the strike-bound Allis-Chalmers plant in Milwaukee of a power generator needed by the Hercules Power Co., Radford, Va., to fill a defense order. Allis-Chalmers has an order for four generators to be used by the Hercules company. Striking CIO unionists have tied up operations at the Allis plant.

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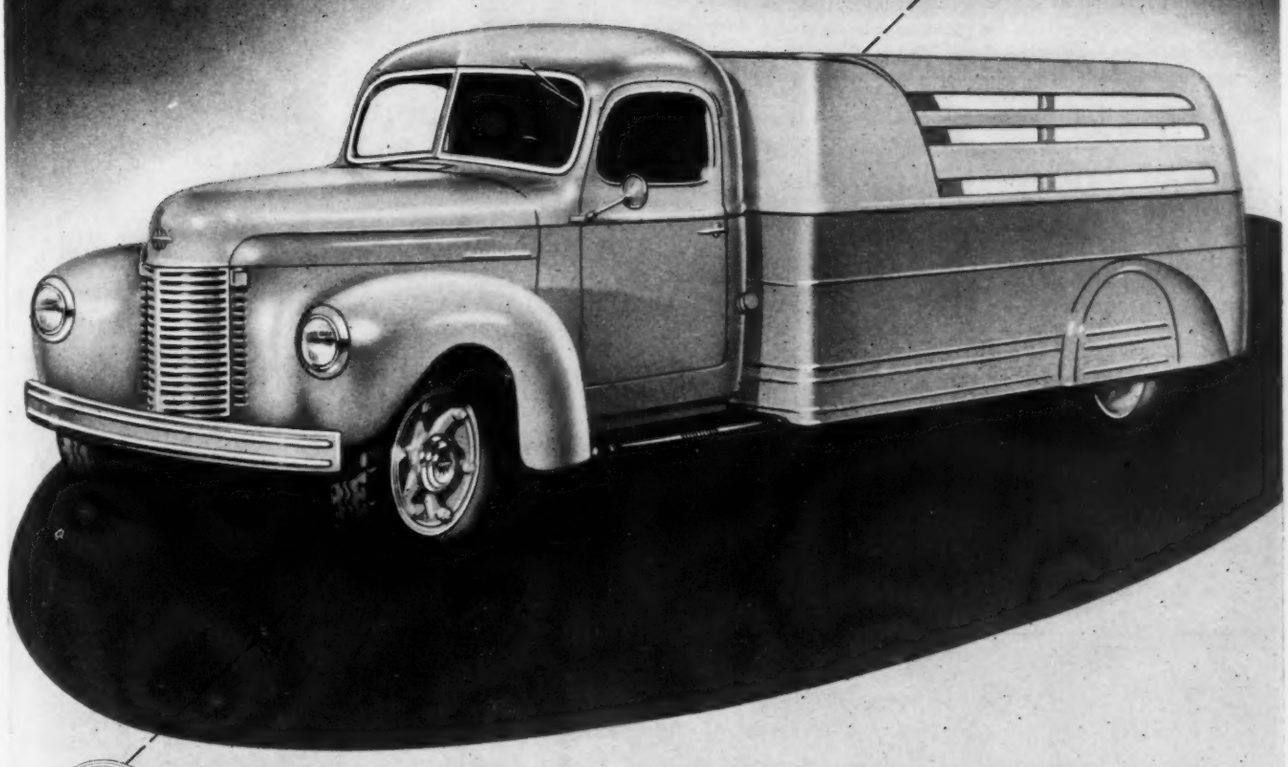
Curtis Lighting New Plant

Curtis Lighting, Inc., is now constructing a modern plant in Chicago which will be completed early in April. At that time the national offices and

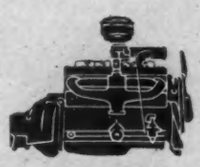
THE *New* INTERNATIONAL TRUCKS*



All-Truck Trucks *Better Than Ever!*

International Harvester is proud to present "The New Internationals"... beautiful in appearance, powered beyond requirements, engineered for unbeatable economy.

The heart of the remarkable economy in all the light-duty models is the new International-built Green Diamond Truck Engine...exclusively International.



The new Green Diamond Engine

The smooth performance of this power-giant, plus its sensational low-cost operation, make these new K-Line Internationals big money-savers on any hauling job.

There are new double-anchor hydraulic brakes; long, easy-riding springs; sealed-beam headlights; safety glass throughout; a new all-steel Safety Comfort-Cab; and many other features.

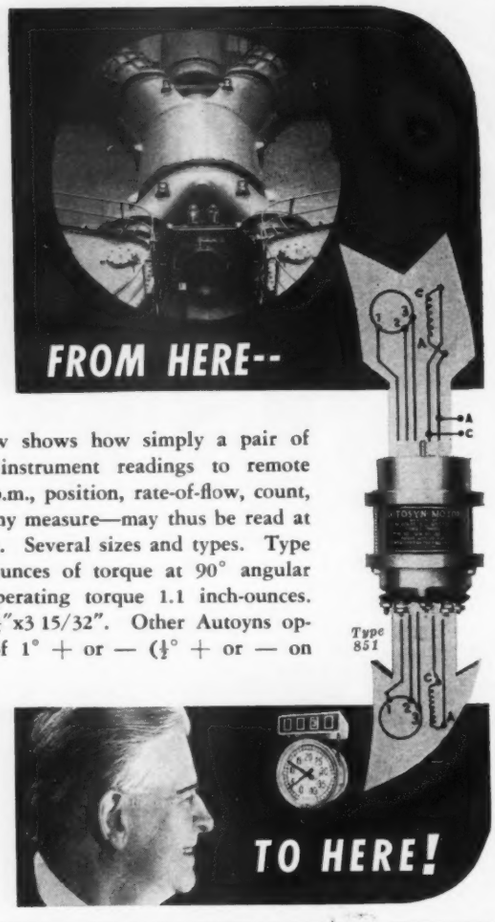
Phone any International Dealer or Branch for a *New* International demonstration. And write for a catalog.

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue · Chicago, Illinois

Remote readings

by means of

BENDIX AUTOSYNS



The circuit diagram in the arrow shows how simply a pair of Bendix-Cory Autosyns transmit instrument readings to remote points. Pressure, station load, r.p.m., position, rate-of-flow, count, dimension, liquid level—almost any measure—may thus be read at a distance in one or several places. Several sizes and types. Type 851 (shown) produces 2.5 inch-ounces of torque at 90° angular displacement—safe continuous operating torque 1.1 inch-ounces. Weight 15.3 ozs. Dimensions 2¾"x3 15/32". Other Autoyns operate within an accuracy range of 1° + or — (½° + or — on special order).

BENDIX AVIATION CORPORATION

MARINE DIVISION

754 Lexington Ave., Brooklyn, N. Y.

TESTED READERSHIP — A McGRAW-HILL PUBLICATION

● Only McGraw-Hill papers carry the TESTED READERSHIP symbol reproduced above. It is the symbol of a program of editorial research which, through personal calls on readers by trained interviewers, picks to pieces issue after issue of Electrical World, and evaluates, in terms of reader interest, every editorial item in the issue.

● TO READERS, this means *extra* value in every issue, because our editors know what *you* are interested in, what type of material is of greatest help to you.

● TO ADVERTISERS, "Tested Readership" is assurance that Electrical World serves a vitally interested body of readers whose needs and interests the editors know and serve specifically.

the production division will move into the new headquarters. The new structure, which is being built in 50 days, will be a one-story, line-production plant, designed to increase Curtis output from 30 to 50 per cent.

•

Vacuum Cleaner Sales Up 21 Per Cent in 1940

Sales of vacuum cleaners during December amounted to 161,311 units, compared with 155,201 units for December of 1939, an increase of almost 4 per cent, according to an announcement made by the Vacuum Cleaner Manufacturers Association.

The total for the twelve months ended December 31 amounted to 1,743,443 units, compared with 1,436,198 units for the similar period of 1939, an increase of more than 21 per cent.

•

Philco Advance Orders Double Record for 1940

Advance orders on the new 1941 Philco refrigerators just introduced are more than double the number of units contracted for at the 1940 convention in January, Larry E. Gubb, executive vice-president of Philco Corp., has announced.

This increase climaxed an upward sales swing throughout last year which resulted in a three times increase in Philco refrigerator sales over 1939, Mr. Gubb stated. Nine models comprise Philco's new line, ranging in price from $114.75 to $259.95.

•

Postpones Dividend

Following a directors' meeting of the Blaw-Knox Co. last week, the company issued this statement:

"In view of the possibility that any dividend action taken prior to March 1, 1941, might result in an increase in the company's excess profits tax for the current year, the board of directors decided to postpone consideration of the initial interim dividend of 1941 until its March meeting."

New York Metal Prices

	Feb. 4, '41 Cents per Pound	Jan. 29, '41 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.50	5.50
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	50.35	50.20
Aluminum, 99 Per Cent.	17.00	17.00

* Delivery Connecticut Valley.

The 15th edition of this book is a veritable encyclopedia on Central Station practice—invaluable as a sales aid and engineering reference for manufacturers and distributors selling to this field, for consulting and power-sales engineers, public service commissions, financial houses. For the central stations themselves, it is an up-to-the-minute roster of the men in other plants whom they are anxious to keep in touch with for personal or business reasons.

This Latest Edition is a complete directory, classifying geographically all operating and holding companies in North America and U.S. possessions; also all plants, both privately and municipally owned. It contains an alphabetical index to all companies listed—over 4,000 of them. Listings include names and titles of all responsible officials; full data on power generation, transmission, distribution, number of meters, etc.

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on the Electric Utility Industry, such as—

...the name of the operating company or companies serving a given community
...the communities served by a given company
...the number of meters connected
...the number of rural customers
...ratings and types of units in generating plants
...type of distribution system and principal distribution voltage
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...names of the administrative, managing and operating officials listed by title for each of the companies
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In short, here's your most comprehensive, up-to-the-minute guide to the more than 4000 electric systems, private and municipal, in the United States, Canada and United States possessions.

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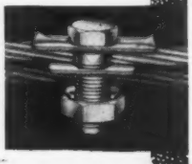

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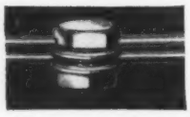

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Conductor Fittings

Field Reports on Business

The increased velocity of national defense orders is swelling production lines of electrical manufacturers. Utilities are buying a variety of equipment, including turbo-generators. An increase in industrial buying is noted. Increase in consumer purchasing power is noted in appliance sales volume.

NEW YORK

Electrical equipment manufacturers are feeling the increased tempo of national defense orders along with expanding orders from utilities and industrial concerns. Orders for the most part are for a wide variety of equipment. A number of new turbo-generators have been ordered by the utilities and more are in prospect. Power transformers, switchgear, network protectors, oil circuit breakers, reactors and stores stocks are being ordered by the electric companies.

Government orders include generators, cable, wire, metering outfits, voltammeters, switchboards, electric ranges, generator sets, transformers, control boxes and generator parts. Reports from Washington indicate that there is plenty of electrical equipment yet to be ordered.

The National Business Show here this week has attracted considerable attention. Electrical machines highlighted equipment.

Reports indicate that priorities will become more pronounced and the number of products to be covered will increase. This is due, in part, to the tempo of buying by industrial consumers which has accelerated since the turn of the year. Some utilities are buying well ahead and this move is likely to become more general.

Baltimore reports a sharp increase in shipbuilding and number of workers employed. A multiple apartment group is being planned to include 31 two-story brick units. Other lands have been acquired for erection of 500 single homes.

Engineering construction awards continue to tend higher. Last week awards were up 57 per cent over the same 1940 week. Private construction is expanding.

NEW ENGLAND

Hartford Electric Light Co. has decided to buy a 45,000-kw. G.E. steam turbine unit and a 450,000-lb. per-hour B. & W. boiler for installation in the South Meadow station about mid-1942. The program represents $4,000,000 to meet increasing power demands of the defense industries.

Small motor sales are running above last year and according to one manufacturer will overtop January, 1940, by nearly 20 per cent. Negotiations are under way for a large amount of switch and control apparatus which is planned for shipyard expansion. Factory lighting is very active; installations vary from small fluorescent jobs using about 3 kw. to more extensive installations requiring as high as 70 kw., one of the latter having been completed in an eastern Massachusetts factory during the past fortnight. Air-conditioning systems are receiving attention.

New Haven R.R. will purchase five new electric locomotives among other items included in its program for improvements during 1941. New housing contracts recently made public will spur on the demand for wiring supplies for light and power. The New Bedford, Mass., Housing Authority is advertising for bids for 400 electric refrigerators.

Central Maine Power reports $881,774 in electrical merchandise sales in 1940 with a million dollar bogie for 1941. A highly successful two-day infra-red conference under the auspices of the Power Engineers Association at Massachusetts Institute of Technology was held at which more than two hundred were in attendance.

PACIFIC COAST

Appliance salesmen, both major and table, report depleted stocks, good buying for January, and a larger unit sale. Pacific Gas & Electric Co.'s domestic customers averaged 1,027 kw.-hr. in 1940, a 4.3 per cent increase. Private construction includes new cable plants and warehouses for General Cable in Emeryville.

Recent orders are largely line or machinery, typical being $305,479 Anaconda Copper Cable for the Oregon City line from Bonneville, $30,994 for its aluminum fittings; $24,679 panels for Bremerton Navy Yard distribution system; a $24,950 Westinghouse elevator for Shasta Dam; $50,000 thin-wall conduit for Central Valley project, and $14,366 to Westinghouse for two 15-kv. circuit breakers for Bonneville. San Francisco building permits for January dropped 25 per cent in value below January, 1940, though private frame construction actually ran 25 per cent above it. Pacific Gas & Electric reports many system betterments, such as rural extensions in Contra Costa and Sacramento counties, new underground runs in Sacramento and San Francisco and several street lighting reinstallations due to street widening in San Francisco and Peninsula cities. A new seven-way shipbuilding yard in Oakland, built to fabricate 30 cargo carriers for Great Britain, will require 4,500 kv. of power and nearly 30,000,000 estimated kilowatt-hours.

CHICAGO

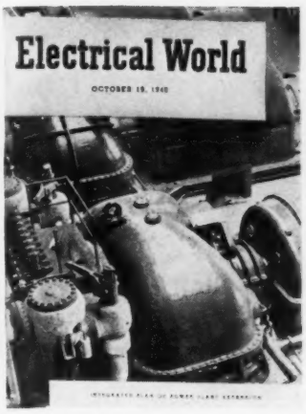
Business activity continued to advance on all fronts, with many lines operating at or near record levels. Orders for electrical equipment pushed steadily upward as further industrial expansion carried forward at a rapid pace. With the defense program providing a huge volume of new business, the indirect benefits of this vast spending are becoming more far reaching in effect each week. Reflecting a gain of 12 per cent in industrial employment and 21 per cent in payrolls, retail and wholesale trade is reported to be averaging 10 to 15 per cent above a year ago. Although there has been considerable acceleration in production and shipments of manufactured products, they are lagging far behind the volume of incoming orders.

National defense contracts totaling $127,166,000 were awarded in this area last week, the aviation engine plant of Buick Motors Co. accounting for the major portion. Electrical equipment included in the other contracts awarded was: Microphones, $493,000; telephone cord, $26,063; rectifiers, $12,634; transformers, $131,000; switchboards, $73,049; X-ray apparatus, $15,615; telephone equipment, $26,186; motion picture projectors, $46,548; electric trucks, $39,160.

The outlook for new building construction is extremely favorable as the January volume reached an eleven-year peak, registering an increase of 242 per cent over the same month last year.

Thanks to You

Electrical World continues to be the most VITAL magazine in its field.



YES, thanks to your cooperation with our editors, and with the trained inquirers whom McGraw-Hill sends out to interview readers, Electrical World continues to provide active leadership.

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On each visit, a specific issue is gone through from cover to cover, and every page, every item, is weighted according to its value to the interviewed subscriber.

An original and farsighted step in journalistic practice, the idea behind the plan is to help the editors better to gauge the needs of subscribers so that they may provide a progressively better service.

This program can be successful only through your cooperation. Thanks to you, it has already been of tremendous help to our editors; and we are confident that the benefits of these interviews will be felt throughout Electrical World's readership.

In the hope that readers may find suggestions for new uses and applications for the magazine in the comments of other readers, we are publishing some of the remarks made during interviews held so far.

READER COMMENTS

"The type of article most useful to me is of a general lighting and merchandising nature. The news issue always interests me and the Personal section helps keep me up to date on the more important organization changes."

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"'Street Lighting in Kingston'—That's right in my line. I copied some of the figures in there. We're about to go into a street lighting campaign so this article was doubly interesting."

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"Had an interesting article about a year ago on Glass tape. Fact that salesman came through about same time made it more interesting. Knew about it before he arrived, thanks to E. W."

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"Distribution Problems—very helpful pointers on different ways of doing. For instance, the article they had about Detroit—I followed out their idea and it's been directly helpful in many ways."

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"Off peak water heaters—had a very interesting article about measuring the number of gallons of hot water used at time of peaks. Had a meter, but never knew at what time or how much the peaks were. The article straightened us out on this all right."

★

"My copy is made available to my men, most of whom read it with regularity. Articles of interest to my department are not only read by my men but clipped and filed under appropriate subject head."

★

"Capacitors Release—This was right in my line—good articles. Commercial Cooking—I'm interested in load building. Editorials—I always read those, I like to get the editor's slant. Operating Practices—I usually find some pretty good information in this. Those outdoor regulators they have in Lynn interested me particularly. I think the magazine is pretty well balanced but of course I can always read more on distribution."

Electrical World

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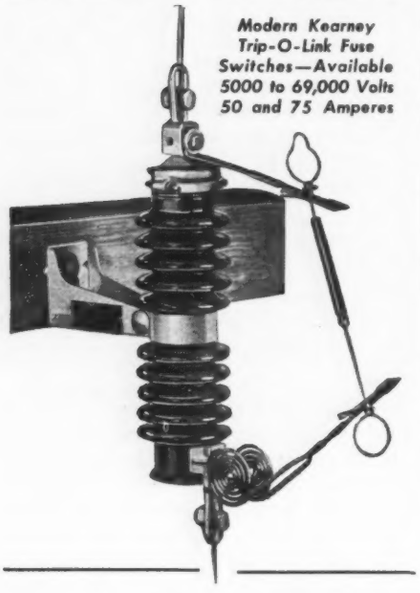

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Copper, Zinc Added to Export Control

Most pressing immediate purpose of the Presidential order adding copper, zinc and related alloys to the export license control list effective February 3 is to conserve domestic facilities for processing and fabricating these metals for war orders. A number of other considerations were involved, international diplomacy and actual indirect conservation of the metal resources of the hemisphere being the most important.

The United States in recent months has been on a net import basis on both copper and zinc. But huge movements of both metals have been coming here for processing and reshipment abroad. This has taxed American facilities which also are under peak demand for smelting, milling and fabricating for domestic orders. Furthermore, domestic need for additional raw materials of both metals are skyrocketing with the daily expansion of the program to arm this country and her allies.

The controls extend to copper and zinc in all forms, including wire of all types, but there is no way of foretelling just how strictly the export controls will be allied. The way recommended for finding out is to apply for a license and see if it is issued. Licences for fabricated products, however, are certain to be more curtailed than those for bulk metal. It should be understood that export controls are not in themselves an embargo; instead, they simply give the government the continuing right to regulate outflow and to stop them at will.

Designed to augment the export controls of copper and zinc is the policy now being quietly negotiated by the government to substitute itself as a buyer for all, or nearly all, of whatever market for these metals Latin America stands to lose through tightening of the export restrictions by this country.

•

Babcock & Wilcox Contract

Babcock & Wilcox Co. has been awarded a contract by Tubize Chatillon Corp. to add one large boiler with pulverized-fuel-burning system at the Rome, Ga., plant.

•

New $100,000 Plant

Walker Electric Co., Atlanta, Ga., has under construction a new $100,000 plant. The new layout will consist of three manufacturing and warehouse buildings and an office structure.

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Available in standard or heavy duty types. For general application to transformers, circuit breakers, etc.

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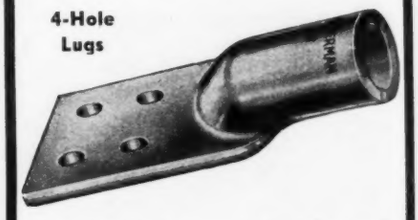

Extra heavy duty type, with plenty of cross section and contact area to carry extremely heavy loads.

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HEAVY DUTY
LUGS

Recent Rate Changes

PENNSYLVANIA PUBLIC UTILITY COMMISSION has under consideration a $3,000,000 rate reduction by the Phildelphia Electric Co. The company declined to confirm or deny the report that it has proposed this reduction to the commission. If the offer is accepted by the commission, it probably would terminate an inquiry into the "fairness, reasonableness and justness" of rates initiated by the commission on its own motion last November when the commission announced that negotiations with the company for "proper rate reduction" had failed.

WISCONSIN PUBLIC SERVICE COMMISSION has announced that about 480,000 customers of electric, water, gas and telephone utilities in the state will save $1,056,000 annually as the result of rate reductions ordered during 1940. The total reductions included $808,048 in savings for 270,442 electric customers.

ALEXANDRIA, MINN., board of public works has announced reductions in rates that will aggregate $10,000 a year savings to users. Services affected include residential, commercial and lake line lighting in the resort area. In most brackets the reduction will be ½ cent per kw.-hr.

KAUKAUNA, WIS., Electrical and Water Department has announced an electric rate reduction, effective February 5, which will mean a saving of $8,000 annually to residential customers, $4,400 to commercial users and $6,600 for rural and street lighting. The Wisconsin Public Service Commission has approved the reduction.

CAROLINA POWER & LIGHT CO. has reduced its minimum rate for rural customers from $3 to $2 a month, effective January 25. It was estimated that the reduction would save users $109,300 a year—$83,300 in North Carolina and $26,000 in South Carolina. Utilities Commissioner Stanley Winborne explained that the reduction was made because "it has been the objective of both this commission and the power company, as the rural territories built up, to make the minimum as low as the income justifies."

•

Four Utilities Granted Certificates for Lines

Certificates authorizing construction and operation of 50.58 miles of rural electric transmission line by four utilities companies in sixteen counties have been issued by the Illinois Commerce Commission.

The certificates authorize the Illinois Iowa Power Co. to build 2.53 miles; Illinois Northern Utilities Co., 41.70 miles; Public Service Co. of Northern Illinois, 3.75 miles, and Central Illinois Light Co., 2.60 miles. Counties in which the line will be constructed are: LaSalle, Madison, Warren, Henderson, Mercer, Kendall, DeKalb, Ogle, Whiteside, Lee, Bureau, Boone, Stephenson, Will, Kankakee and Sangamon.

In another order the commission granted a certificate to the Illinois Iowa Power Co. to construct 1.45 miles of 11,000-volt power line in Bond and Clinton counties.

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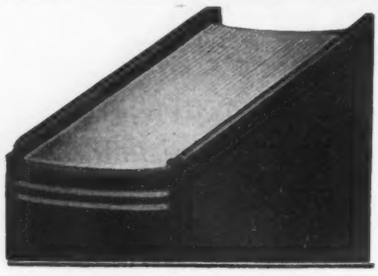

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REA Allots Funds; Contracts Approved

Harry Slattery, Administrator of Rural Electrification, has recently announced allotments totaling $5,515,000 for rural electrification in various states. These allotments provide for the establishment of seven new power systems, one of which also includes funds for generating facilities, the enlargement of eighteen co-operatives, and loans to two private utilities.

These new allotments bring the total made by REA since it was established in 1935 to $357,886,621.

Among the new allotments are the following:

ARKANSAS—Carroll Electric Co-operative Corp., Berryville, Paul F. Arnold, supt., $139,000 to build and acquire 185 miles of line, 699 members in Benton, Carroll and Madison counties, Arkansas, and the village of Huntsville, Ark., and Stone County, Mo.

ILLINOIS—Egyptian Electric Co-operative Assn., Inc., Steeleville, Theodore F. Fieker, supt., $300,000 to build 322 miles of line, 841 members in Jackson, Randolph, Perry and Williamson counties.

IOWA—Eastern Iowa Light & Power Co-operative, Davenport, S. N. Jordan, supt., $344,000 to build 421 miles of line, 945 members in Clinton, Cedar, Louisa, Scott, Muscatine, Johnson and Washington counties.

KENTUCKY—Fox Creek Rural Electric Co-operative Corp., Lawrenceville, Roy York, supt., $119,000 to build 132 miles of line, 403 members in Franklin, Mercer, Spencer, Henry, Anderson, Woodford, Shelby and Washington counties.

LOUISIANA—Dixie Electric Membership Corp., Baton Rouge, E. B. Thompson, manager, $125,000 to build 198 miles of line, 518 members in Livingston, Ascension, East Baton Rouge, Tangipahoa, East Feliciana, West Feliciana and St. Helena Parishes.

MICHIGAN—Presque Isle County Electric Co-operative Assn., Posen, Gustav J. Kleber, supt., $299,000 to build 103.1 miles of line, 321 members in Cheboygan, Presque Isle, Montmorency, Oscoda and Alpena counties and to acquire generating facilities.

MISSOURI—Black River Electric Co-operative, Annapolis, Ray Brown, supt., $203,000 to build 224 miles of line, 720 members in Madison, Wayne and Iron counties.

NEBRASKA—Stanton County Rural Public Power District, Stanton, Clark Colborn, supt., $29,000 to build 32 miles of line, 75 members in Stanton and Wayne counties.

NEW MEXICO—Stonewall Electric Co., c/o Albuquerque Gas & Electric Co., Albuquerque, Arthur Prager, correspondent, $216,000 to build 282 miles of line, 462 members in Bernalillo, Santa Fe, Torrance, Valencia and Socorro counties.

NEW YORK—New York State Electric & Gas Co., Ithaca, John L. Burgan, director, $500,000 to build 453.5 miles of short extensions to the company's existing system, 1,666 consumers.

NORTH CAROLINA — Pamlico - Beaufort Electric Membership Corp., Grantsboro, R. M. Harris, president, $127,000 to build 119 miles of line, 533 members in Pamlico and Beaufort counties.

OHIO—Washington Electric Co-operative, Inc., Marietta, $20,000 to build 1½ miles of line, 27 members in the town of Antioch, to construct a substation and for member-service connections.

OKLAHOMA—Northwestern Electric Co-operative, Inc., Woodward, Wilfred Johns, president, $234,000 to build 323 miles of line, 588 members in Woodward, Ellis, Major, Dewey and Harper counties.

PENNSYLVANIA—Claverack Electric Co-operative, Inc., Towanda, Clarence E. Jakway, manager, $150,000 to build 149.4 miles of line, 503 members in Bradford, Susquehanna, Wyoming, Sullivan and Luzerne counties.

TENNESSEE—Forked Deer Electric Co-operative, Halls, W. C. Patton, attorney, $337,000 to build 340 miles of line, 1,757 members in Dyer and Lauderdale counties.

TEXAS—Fannin County Electric Co-operative, Inc., Bonham, Alonzo Chaffin, supt., $160,000 to build 221 miles of line, 597 members in Fannin, Collin, Hunt and Grayson counties.

VIRGINIA—Accomack Northampton Electric Co-operative, Exmore, G. B. Marean, president, $329,000 to build and acquire 282 miles of line, 1,595 members in Accomac and Northampton counties; $100,000 to build and acquire generating facilities.

Construction contracts recently approved include the following:

OKLAHOMA — East Central Oklahoma Electric Co-operative, Inc., Okmulgee, D. A. Turinsky, supt., and Midwestern Engineering & Construction Co., 307 Drew Bldg., Tulsa, engineer, contract to the Elkhorn Construction Co., Norfolk, Neb., 183.74 miles, 410 members; bid, $109,650.

OREGON—Malheur Co-operative Electric Assn., Vale, Ore., Leland S. Heller, supt., and H. B. Lee, Vale, Ore., engineer, contract to Newport Construction Co., N. E. 70th and Halsey St., Portland, 93 miles of line, 69 members; bid, $52,756.

SOUTH CAROLINA—Mid-Carolina Electric Co-operative, Inc., Lexington, M. Wise Caughman, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to R. H. Bouligny, Inc., 433 W. Morehead St., Charlotte, N. C., 243.2 miles of line, 594 members; bid, $138,325.

TENNESSEE—Holston Electric Co-operative, Rogersville, J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Nile E. Yearwood, Nashville, 219 miles of line, 756 members; bid, $135,986.

TEXAS — Karnes Electric Co-operative, Inc., Karnes City, R. H. Hoffman, supt., and Beavers and Lodal, 1411 Smith-Young Tower, San Antonio, engineer, contract to the Zanes Freight Agency, 1500 S. Preston St., Dallas, 300 miles of line, 439 members; bid, $146,459.

VIRGINIA—Bull Run Power Co., Manassas, Welles Engineering Co., Front Royal, engineer, contract to Rockingham Construction Co., 394 N. Main St., Harrisonburg, 60 miles of line, 171 members; bid, $64,064.

WISCONSIN—Grant Electric Co-operative, Lancaster, Clyde G. Newcomb, supt., and Wisconsin Development Authority, Tenney Bldg., Madison, engineer, contract to E. W. Wylie, Inc., 2239 Ford Road, St. Paul, Minn., 168 miles of line, 298 members; bid, $104,152.

WYOMING—Rural Electric Co., Pine Bluffs, George N. Phillips, supt., and Walter W. Flora, 1618 Russell St., Cheyenne, engineer, contract to Inland Construction Co., 3867 Leavenworth St., Omaha, 149.4 miles of line, 153 members; bid, $100,721.

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"IRVINGTON" YELLOW STRAIGHT CUT VARNISHED CAMBRIC AND TAPE have superior resistance to transformer and lubricating oil, good aging and insulating qualities, and resistance to moisture.

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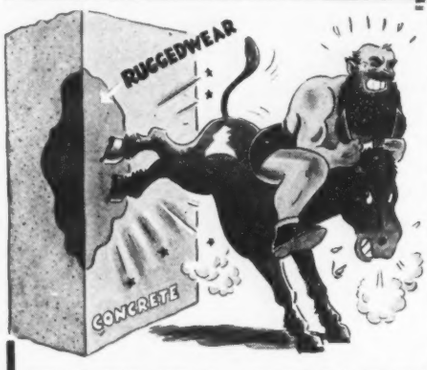

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Slam it! Sock it! Smash it! You can't harm a RUGGEDWEAR patch. Cellulose-Processing makes RUGGEDWEAR RESURFACER far tougher than ordinary concrete. Sticks tight at the joint—won't crack out. RUGGEDWEAR'S smooth, resilient surface provides excellent traction. A heavy blow causing indentation gradually irons out under traffic. Easily applied. Install RUGGEDWEAR Saturday afternoon — run traffic over it Monday morning. Used over wood or concrete—over entire area, indoors or out. Only 10¢ to 14¢ per sq. ft.

Valuable 74-page "HAND BOOK OF BUILDING MAINTENANCE" available to those requesting on business letterhead.

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Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER —no obligation.

Name .....
Company .....
Address .....
City..... State.....

Traveling Capacitors Are Versatile Tool

[*Continued from page 67*]

current would flow through the current relay shunting the by-pass gap to operate this relay.

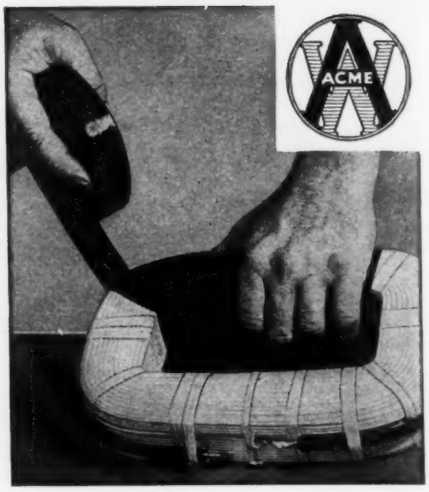
Protection for the workmen is also provided. The housing is provided with two doors through which a person can enter and operate the main switch and carry out necessary maintenance and adjustment work on relays and other equipment. All the control and switching equipment is located in a compartment separate from the live power equipment as an added safety precaution. Access to the energized equipment is provided by removable panels latched on the inside by two rods, one on each side of the switch house. One rod is controlled from the operating compartment and the other from one of the cable compartments. The main doors are provided with locks so that the entire assembly can be closed and left without an attendant while it is in service. "Danger" signs on the sides and rear warn of the energized equipment.

The trailer was built by the Fruehauf Trailer Company and delivered to the Pittsfield (Mass.) works of the General Electric Company, where the capacitor and switching equipment were assembled in the housing and mounted on the trailer.

Versatile Application

Specific uses to which the equipment has been put include: (1) At an 11,000/4,000-volt substation some changes were being made to accommodate a second three-phase transformer and it was necessary to have the substation out of service several days. The 4,000-volt tie lines were closed and the portable capacitor connected to the circuits at the station, where it held the voltage satisfactorily. With this assistance the work was completed during normal working hours, whereas without it it would have had to be done at off-peak periods, largely with overtime charges. (2) At another 11,000/4,000-volt substation, where the feeder automatic reclosing circuit breaker was renovated and other improvements were carried out, the station was out of service several days, but again the capacitor handled the voltage control satisfactorily.

More recently a turbine was to be



Bias Tapes with
PLENTY OF STRETCH!

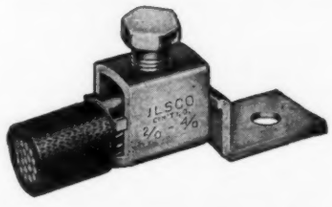
THEY fit snugly into all corners and crevices. Their exceptional flexibility and tensile strength are due to an Acme developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabrics. Offered in bias or straight tapes, and in rolls up to 36" wide —yellow or black. Samples if requested.

The Acme Wire Co., New Haven, Conn.

Acme Wire Products
VARNISHED INSULATIONS — MAGNET WIRE COILS.

ILSCO
SOLDERLESS CONNECTORS

HAVE YOU TRIED
The New Ilsco Lugs?



BUILT FOR OVERLOADS!

The new design — as passed by the Underwriters' Laboratories May 1, 1940.

Write for Samples today, —Along with the New Catalog.

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5629 MADISON ROAD — CIN., O.

ASPLUNDH

This is where you get perpetual freedom from utility line failure due to trees; a preservation of public good will; a contract to fit your individual needs and in addition a swell job economically.

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TREE EXPERT COMPANY
JENKINTOWN,
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OGONTZ 3750

Line Clearance Exclusively

taken out of service for extensive repairs at a small steam-electric station at a remote point on the system. The capacitor was set up to hold the voltage while this turbine-generator was not available; it took care of the situation very nicely.

Powerton-Crawford 220-Kv. Line

[*Continued from page 71*]

Particular care was taken to check all items that went into the line as possible sources of radio interference. Attention was given to conductor size, adequate insulation and clearances and to the elimination of sharp edges on hardware. Measurements with the conductor energized, including radio noise-influence voltage and field strengths near the assembly over a wide range of frequencies, indicated that no trouble would result from corona and radio noise. This was confirmed after the line went into service by field surveys covering areas near the line. A frequency range of 150 kilocycles to 125 megacycles was explored. Typical data are shown in the accompanying graph. Radio noise field strengths showed a rapid decrease transverse to the line. At the ultra-high frequencies, which are coming into greater use in aviation radio, radio noise was found to be almost negligible.

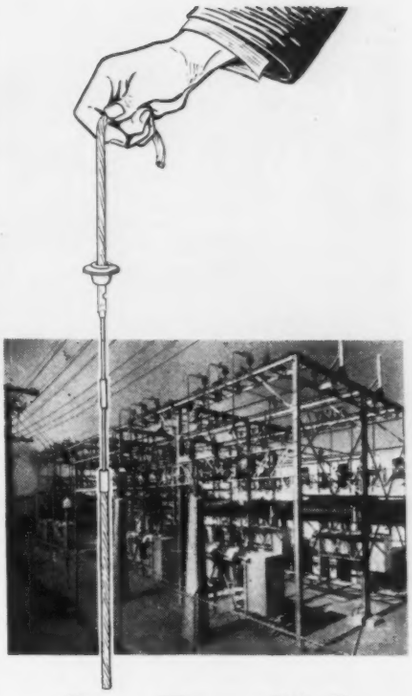
•

Association Organized by Valuation Engineers

Formation of the Technical Valuation Society, Inc., a nation-wide nonprofit membership group with headquarters in New York City, was recently announced.

The society was formed to meet the need of an organization to discuss mutual problems of engineers and accountants in valuation work. The objects of the society, as set forth in its constitution and by-laws, include: (1) Establishment of valuation engineering as a professional degree; (2) to promote intercourse between engineers and accountants in the valuation field, including regulatory officials; (3) to advance valuation engineering standards; (4) to foster valuation engineering education; (5) to broaden the scope of valuation engineering in co-operation with other professional societies.

Technical sessions and bulletins are planned to carry on this program. The society's secretary is G. A. Rappold.



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Complete Substation

Now that our Nation's Defense Program is placing increased demands on your power system, this fact will interest you: *Southern States Equipment Corporation can furnish you with equipment ranging from one fuse link to a complete substation.*

Southern States manufactures a complete line of connectors, bus supports, fuses, switches and motor mechanisms. Transformers, lighting arresters and breakers used on complete substation orders are supplied by reliable manufacturers.

Southern States pioneered dropout and reclosing fuses and has developed some of the most dependable switches and motor mechanisms since its founding in 1916. This pioneering spirit is carried on today by our staff of competent engineers who are delegated to work with you on any of your problems.

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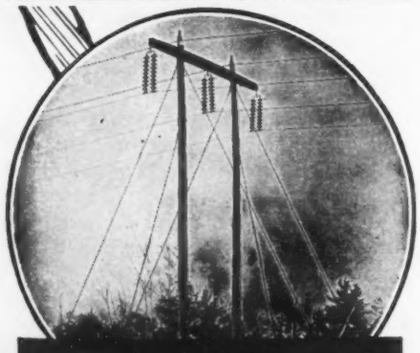
Bus & Cable Connectors
ASK FOR BULLETIN 38-D

TYPE "FT"
Solderless Connectors

Interchangeable halves, DURONZE bolts and nuts. Rounded edges prevent conductor stress.

Electrically and mechanically proportioned to the size of bus, these connectors carry full rating of extra heavy tubing corresponding to the tap size.

DELTA-STAR ELECTRIC CO.
2400 BLOCK FULTON ST.
CHICAGO, ILLINOIS.



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STRENGTH, ruggedness and durability are combined with definite economy in *Crapo* Galvanized Steel Strand. Low first cost, low maintenance expense are matters of record wherever this time-tested product is in use. Available in all standard grades and sizes from representative jobbers throughout the country. Or, write—

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Sales Opportunities

DALLAS, TEX.—Dallas Power & Light Co. plans new 60,000-volt transmission line from Mountain Creek generating station to Hensley Field, in vicinity of city, for power supply for new airplane-manufacturing plant of North American Aviation, Inc., Inglewood, Calif., now in course of construction at that place. Power substation for step-down service will be built at plant site. Entire project will cost close to $100,000. Work will begin soon. North American company, noted, will install motors and controls, feeder lines and complete industrial electrical facilities for plant service, with works to consist of six main one-story units for parts production and assembling. Output will be for Government, which is providing fund of about $5,000,000 for project. J. Lloyd Allen and John R. Kelley are architects, and Gordon Turnbull, consulting engineer, all Architects' and Builders' Building, Indianapolis, Ind., for aircraft plant.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, Knoxville, receives bids until February 17 for quantity of varnished cambric insulated cable for generator and transformer leads for units Nos. 9 and 12, Wilson Dam hydroelectric power plant. Also, at same time, for carbon dioxide fire-extinguishing equipment for same generating units.

STAFFORD, KAN.—City Council plans extensions and improvements in municipal power plant, including installation of additional equipment. Paulette & Wilson, 1006 Kansas Avenue, Topeka, Kan., are consulting engineers.

MEDFORD, ORE.—California-Oregon Power Co. plans extensions in transmission lines in Seiad Valley district. Also will make other extensions and improvements in high-tension lines in different parts of system, including expansion in power substations and other line-operating facilities. Work will be carried out in connection with development and improvement program in 1941, for which a gross appropriation of about $1,200,000 is being arranged. Company has plans under way for rebuilding of Gold Ray power dam in Rogue River, for increased service for hydroelectric station at that point.

LOS ANGELES, CALIF.—California Shipbuilding Co., care of Bechtel-McCone-Parsons, Inc., 601 West Fifth Street, engineer, plans installation of transformers and accessories, switchgear, motors and controls, duct lines, exterior and interior industrial lighting facilities, standby units, conveyors, electric cranes and hoists, and other equipment in new shipbuilding plant on West Basin, Los Angeles harbor, for construction of cargo vessels for United States Maritime Commission, Washington, D. C. Plant will consist of series of eight shipways, with outfitting pier, docks, group of shops and miscellaneous structures. A boiler house will be built. Entire project will cost about $4,766,000, with financing to be arranged through Government. Company was organized recently by engineering company noted, Todd Shipyards Corp., 1 Broadway, New York, N. Y., and other interests.

DEMING, N. M.—Bureau of Reclamation, El Paso, Tex., receives bids until February 25 for construction of new 115-kv. transmission line from Elephant Butte hydroelectric power station to Deming, and thence to Central, N. M., about 118 miles, in all. Line will be three-phase, single-circuit, using H-frame wood poles, with 133,000 cm. hollow copper conductor. Materials in part will be furnished by Government (Specifications 954).

SPOKANE, WASH.—Washington Water Power Co., Spokane, has plans maturing for new two-story service and operating building, about 130 x 210 feet, with meter and equipment repair departments, equipment storage and distribution facilities. A one-story garage structure for company trucks and cars will be built on adjoining site. Cost estimated close to $250,000, including equipment.

MILWAUKEE, WIS.—Nordberg Manufacturing Co., 3037 South Chase Avenue, manufacturer of engines, compressors and allied products, plans installation of motors and controls, transformers and accessories, duct lines, switchgear, industrial lighting equipment, electric hoists, conveyors and other equipment in new plant additions for production of torpedo tubes for Navy Department, Washington, D. C. Expansion will comprise a group of nine one-story buildings, totaling about 200,000 square feet of floor space. Cost estimated close to $800,000, with appropriation in that amount to be provided by Government.

PHOENIX, ARIZ.—Bureau of Reclamation, Denver, Colo., receives bids until February 27 for control switchboards and instrument transformers for installation in power substation at Phoenix, Parker Dam power project, Arizona-California. Equipment will be installed by Government (specifications 1474-D).

DETROIT, MICH.—Republic Aircraft Products Corp., 5914 Federal Street, manufacturer of airplane parts, accessories, etc., plans installation of motors and controls, regulators, duct lines, industrial lighting system, switchgear, electric hoists, conveyors and other equipment in new addition to plant, to be used for production of aircraft engine parts for Navy Department, Washington, D. C. Fund of about $532,000 has been arranged for project through Government.

EDGEWOOD, MD.—Chemical Warfare Service, United States Army, Edgewood Arsenal, Edgewood, receives bids until February 14 for 20 electric motors, five electric ovens, five electric combustion furnaces, five electric water baths, five electric muffle furnaces, five electrically-heated stills, 10 electric hot plates, 10 electric heaters and other equipment (Circular 871).

BIRMINGHAM, ALA.—Alabama Power Co. is arranging fund of about $2,000,000 for line department in 1941, including new transmission and distributing lines in different parts of territory, and extensions in primary and secondary lines for expansion in rural electric system. Approximately $500,000 of total fund noted will be used for latter work, including power substation units and service facilities.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until February 14 for switchboard panel and electrical equipment (Schedule 5136).

for NIGHT REPAIRS and LINE PATROL

CENTRAL Linemen's Flare Lights

An efficient, economical form of portable illumination—giving daylight vision for night repairs and line patrol work. Unaffected by wind, rain or snow. Two sizes—20 or 30 minute lighting periods.

Central Linemen's Flare Lights are invaluable during outages or other emergencies when quick dependable illumination is imperative. Easily lighted in any weather by self contained friction cap. No matches required. Stick in a post, tree, cross arm, in the ground or carry by hand.

They're always ready, and provide more than ample illumination. Standard equipment with prominent utilities throughout the land.

STANDARD PACKING

No. 3020—20 min., 72 per case....$12.00
No. 3030—30 min., 36 per case.... 9.00

Utility men: Send for free sample on your company letterhead.

Central Railway Signal Company, Inc.

272 Center Street
NEWTON, MASS.

Plant Locations: Hammond, Ind.; Needham Hts., Mass.

Electric Cooking Builds a Business

[*Continued from page 77*]

enced from other installations, since you so recently installed our third unit at 9 West Michigan to take care of our delicatessen cooking.

A few weeks ago I became curious to know what our complete electric cost was in percentage to our volume of sales at the Ritzee Hamburg Shop at 51 North McCamly. Believe it or not, the percentage was only 3 per cent, and when I tell you everything used and hours open, you can guess how pleased I was.

Included in the load of the electric current used at Ritzee No. 2 is 5,000 watts of lighting, electric griddle, grill, toaster, coffee urn, two malted mixers, two compressors, range, steam table, meat grinder, cake mixer, victrola and three motors. The open hours are from 6 a.m. to 3 a.m.

Later in 1940 a small sandwich shop in one of Battle Creek's suburbs failed in business. Ritzee Hamburgs, Inc., took over the place, remodeled it, installed all-electric cooking equipment and opened Ritzee Hamburg No. 3. This shop, although smaller than the others, has been very successful.

Their latest and most elaborate venture is Ritzee Hamburg No. 4. This business represents a total investment of more than $30,000. It is located in Grand Rapids, Mich., in the downtown area, and although it has been open only a few months, I believe it is going to be the most successful business venture they have ever made.

It is my opinion, also the owners', that the success of Ritzee Hamburgs, Inc., is largely due to the use and the advertising of the use of electric counter cooking equipment.

•

Refrigerator Trade-ins

The Wisconsin Radio, Refrigeration and Appliance Association estimates that from 20 to 30 per cent of the refrigerator sales in 1941 in the Milwaukee area will involve trade-ins of used electric refrigerators which should be reconditioned before being resold. It estimates that the total will be from 2,000 to 2,500 units.

•

PUD Bonds Offered

Offering has been announced of a new issue of $6,750,000 of 2½, 2¾ and 3 per cent Consumers Public Power District, Central Nebraska Division, electric revenue bonds due 1942 to 1971. The bonds were priced to yield 1.25 to 3.15 per cent.

Engineers of many large Operating Companies now Specify

DURAPOLE

WESTERN RED CEDAR

The pole with extended service life above the ground

LONGER POLE LIFE

BETTER APPEARANCE
BETTER PUBLIC RELATIONS

Sapwood decay is prevented in the DURAPOLE because of FULL LENGTH MACHINE SHAVING and FULL LENGTH CREOSOTE TREATMENT. This means longer service life above the ground line when using DURAPOLES. Machine shaving does not change the contour of the pole but does greatly improve its appearance; thus creating improved public relations. These advantages and others (see below) come to you for a nominal additional charge to the standard butt treated cedar pole.

These are the benefits that make DURAPOLE today's cost-saving purchase

MACHINE SHAVED — for increasing life of the pole above ground — for improved appearance.

FULL LENGTH TREATED — for sterilization of sapwood — for thorough treatment of all bolt holes and checks — for uniform light brown permanent color.

SLAB GAINED — for perfect drainage — for secure arming — for much better appearance.

Butt treated ⅛" guaranteed penetration —no reduction of sapwood in butt section.

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A.I.E.E. Sessions

[*Continued from page 65*]

sen coil as a means for clearing momentary faults.

Ten years of field testing of bushing power factor has shown major difficulties with gaskets and a ready means for gasket replacement is desirable said I. W. Gross (A.G.&E. Service). He hopes to see extension of the constant-gasket-pressure principle to lower voltage bushings. The completely sealed bushing is to be desired and the top seal should be soldered and not gasketed, said F. O. Wollaston (Commonwealth Edison).

Relays; Current Inrush

Prolonged Inrush Currents with Parallel Transformers Affect Differential Relaying. By C. D. Hayward (General Electric).

Reports Ohio Edison and laboratory tests occasioned by false relay action attending high magnetizing transients in transformers already energized when others were connected in. The magnitude increases with increased equivalent resistance of the line between these transformers and the source; line inductance has less effect, nor does loading prevent the phenomenon. Harmonic-restraint transformer differential relay is appropriate provided only one transformer is included in differential zone.

An Improved Polyphase Directional Relay. By B. V. Hoard (Westinghouse).

Inductor loop principle extended to obtain high-speed directional relay with simplicity, low burden, high sensitvity and non-bounce contacts. Expected to replace polyphase induction-disk type.

Modern Relaying for A. C. Secondary Network Systems. By D. L. Beeman (General Electric).

Outlines application of new three-phase, single-element induction cylinder network master relay with line-to-line connected potential coils. Produces greatly increased tripping torque during unbalanced primary feeder faults. Advantageous for light-density networks.

Phenomena similar to those in the Hayward paper were experienced on a 12-kv. bus of the Commonwealth Edison system and E. L. Michaelson told of them in connection with three transformers totaling 8,750 kva. (6,000 kva. delta-delta, 2,000 delta-delta and 750 delta-wye). Roy M. Smith (Westinghouse) expressed for his associate Sonneman the idea that occurrences of such phenomena were infrequent; E. T. B. Gross of Cornell reported similar transformer behavior in Prague, however. A. E.

Just off the press!

THE NEW NATIONAL ELECTRICAL CODE HANDBOOK

covering the new 1940 Code

FIFTH EDITION FULLY REVISED

By Arthur L. Abbott

585 pages, 5 x 7½ illustrated, $3.00

Here is the electrical contractor's job book almost completely rewritten in accordance with the new 1940 Code requirements, planned to enable electricians to understand the new rulings of the National Electrical Code and to do work in accordance with the Code.

Simplifies the Code for quick, easy application

It restates rules in simple language, plus explanations, practical directions, and diagrams, showing what the rules mean and how to apply them. *It groups rules in special arrangements, making it easy to find ALL rules applying to any given job.*

IMPORTANT NOTE

The new 1940 Code contains more changes than any previous Code, and the new ABBOTT covers fully every item of this new Code.

Some features of this new edition

- Contains a handy reference table that shows at a glance just what lighting and appliance loads may be connected to each of the five types of branch circuits described in Art. 210.
- Concisely explains complicated new rules in the Code under which 17 difficult types of insulated conductors are recognized.
- Clarifies provisions relating to carrying capacities, rubber-insulated wires, small-diameter wires for re-winding, insulations for extra high temperatures, etc.
- Presents the motor wiring and protection tables, always an important feature of the Handbook, in a new form which makes easy the solution of problems which arise when determining the rating or setting of fuses or circuit breakers protecting motor branch circuits.

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330 West 42nd Street, New York.

Send me Abbott's National Electrical Code Handbook for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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(Books sent on approval in U. S. and Canada only.)

Flink (Ohio Edison) felt that the difficulty of spurious relay action from transformer inrush currents was more likely to occur with transformers having inherently high magnetizing currents.

On the Westinghouse directional relay W. R. Brownlee (Commonwealth & Southern) appreciated the freedom from variation in response with varying position of the moving elements. The induction loop principle appeared to him to be twice as fast as disk types.

Electrical Machinery

Suppression of Magnetic Vibration and Noise of Two-Pole Turbine Generators. By **A. L. Penniman, Jr.** (Consolidated Gas, Electric Light & Power) and **H. D. Taylor** (General Electric).

Westport station's 31,250-kva. air-cooled generator has non-resonant stator frame and resiliently mounted core. Spring members are twin sets of spring-bars attached to bore of frame, each group arranged in three groups longitudinally. Core-stack key-bars attached to spring-bars midway between stator supports. Machine operating since August 10, 1940. Man standing alongside cannot "detect by touch or hearing the application or removal of field excitation."

The Audio Noise of Transformers. By **W. C. Sealey** (Allis-Chalmers).

Noise originates principally in magnetostriction of the core iron. Noise reduction through use of steel of lower magnetostriction predicted. Noise can be calculated from design constants. Sound intensity for similar transformers with equal core induction varies as 2/3 power of weight and as square of magnetostriction. Effect of latter is 0.0002 in. elongation of 100-in. typical punching.

A Study of Sound Levels of Transformers. By **H. Fahnoe** (Westinghouse).

Concurs on magnetostriction cause. Except by reducing it, "no means have been found by which the sound level may be economically reduced." Research continuing. Core deflections, velocity of core vibrations, noise spectrum of transformer steel, resonance curves and modes of vibration of shell types presented.

The method of reducing vibration in two-pole generators described by Penniman and Taylor in their paper corresponds closely with that devised by C. M. Laffoon and himself, said B. A. Rose (Westinghouse) and applied to a large unit in Waterside station. Smaller machines—perhaps up to 25,000 kw.—do not require special provision for vibration reduction, said Mr. Taylor in closing the discussion.

Higher harmonics are not a significant contributor to audio noise in transformers, said C. Mannal (General Electric) in discussing the two papers on that subject by W. C. Sealey and H. Fahnoe. The major causes of noise are known and can be controlled.

Fluorescent Lighting

Fluorescent Lighting Fills a Gap. By **Arthur A. Brainerd** (Philadelphia Electric).

Low brilliancy, large area source, good diffusion readily obtained. Shadows minimized, glare discomfort small, low specular reflection, high efficiency. Long life, colors available for decorative effects, daylight readily approximated. However, it is bulky, light is difficult to project, maintenance intensified with multiplied units, cost relatively high. Many appropriate applications discussed.

Development of the Glow-Switch. By **R. F. Hays** (Westinghouse).

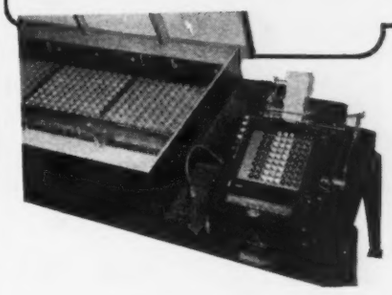
Automatically starts fluorescent lamps, functioning thermally without heater element with time-delay characteristics. At one value of E the R is a fraction of an ohm, but it becomes megohms at slightly lower voltage. Economically produced on automatic machinery. Operates good lamp 1,000,000 times; lasts 100 hours on failed lamp.

While the average lighting intensity in all industry is less than 10 foot-candles (D. W. Atwater, Westinghouse) the average in new factories is now 40 to 50 foot-candles. Efficiency of fluorescent lamps in last ten months has increased 28 per cent in daylight and 51 per cent in white (O. P. Cleaver, Westinghouse). The white takes up 52 per cent of total production, daylight 43 per cent and colors 5 per cent. There is now an adequate supply of well-designed equipment for fluorescent lighting (A. B. O'Day, General Electric).

Analysis of 125 fluorescent installations (Preston Millar, E. T. L.) showed three-quarters direct lighting, average intensity at point of utilization 36 foot-candles and over entire area 28 foot-candles, average power factor better than 90 per cent. Where fluorescent had displaced incandescent, total wattage including auxiliaries averaged 93 per cent of former (minimum 25 per cent, maximum 229 per cent).

Greatest advance so far in lighting with high-voltage fluorescent is where it is combined with incandescent (J. A. McDermott, city of New York). New field in decoration is opening up with 1- to 2-watt per linear foot tubes which can flood surfaces with color.

Saved more than $2500. in making an accurate bill analysis



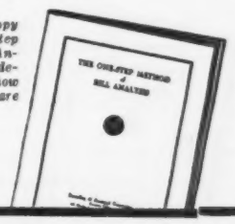
The One-Step Method of Bill Analysis . . .

The reason the R & S one-step method of bill analysis costs you only a fraction of a cent per item is because greatly simplified procedure enables us to provide you with accurate information in a minimum of time. Wherever Customer Usage Data at lower cost . . . in less time . . . is wanted, the R & S Method of bill analysis will give it to you.

Customer Usage Data Lower Cost . . .
. . . Less Time

The standard report shows 1—The kw. hrs. per bill; 2—The number of bills; 3—Consumption in kw. hrs.; 4—Cumulative number of bills; 5—Cumulative consumption in kw. hrs.

Write for your copy of "The One-Step Method of Bill Analysis" which describes briefly how these savings are made.



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Supervision of Construction
2 So. Central Ave. — Clayton, Mo.

THE J. G. WHITE ENGINEERING CORPORATION
Engineers — Constructors
New York, N. Y.

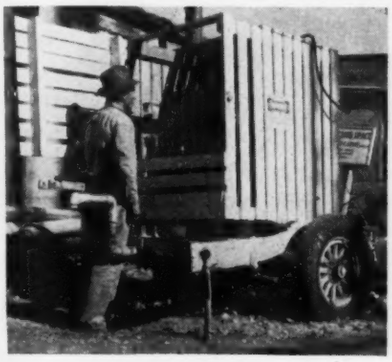
READERS MAY CONTACT
the consultants whose cards appear on this page with the confidence justified by the offering of these special services nationally.

LETTERS TO THE EDITOR

Service Trailer

To the Editor of ELECTRICAL WORLD:

The "Hurry-Up" service trailer illustrated and described on page 88 of ELECTRICAL WORLD for December 14 interested us very much. We built one a year ago and have used it since. Ours, exclusive of the 37.5-kva. "CSP" transformer, cost $40. It does the work and the heavy rubber-covered ("Tirex") cables make it perfectly safe. All leads end in hot-line taps. The unit can be taken to a job and hooked up in a very short time.



Incidentally, the major part of the cost was for tires for the truck wheels used, the truck rear end coming from a junk yard for very little cash.

E. A. ROBERTS, Manager,
Southwestern Public Service Co.,
Carlsbad, N. M.

P.S.—Our line foreman, T. J. Pope, is shown looking in the open front "gate." The idea was his and he did most of the work.

•

Who Did What and When and Why?

To the Editor of ELECTRICAL WORLD:

Many pioneers in the electrical industry have retired or died. Unless we act quickly the "minds of those yet living will be stilled forever and the loss will never be recoverable," quoting your editorial of January 27, 1940.

For more than two years I have been compiling the first broad history of the evolution of the electrical industry for the Association of Edison Illuminating Companies. Because of this history's scope, the hope was that it would place on record in one place the major contributions of the industry and its leaders. Comments from numerous reviewers praise the work done so far (1879-1922 inclusive). I personally feel, however, that nothing but a record of men will do full justice to individual pioneers, although this history of the industry is necessary to orient their works.

The Reason

Human beings—their thoughts and actions—constitute the most interesting thing in life. There is no more inspiring, romantic or dramatic story than is to be found in the lives of utility men. Their early aspirations, their personal associations, their tribulations and accomplishments, even what they think or thought of opponents' viewpoints, would make an entrancing story if compiled.

Such human-interest material has been incorporated to some extent with this history of the industry. But collection of such material, more than that of physical or economic manifestations of evolution, requires neverending laborious research or contacts with more persons than a single individual can make in a lifetime Records of men are scattered or existent only in private far-flung collections.

The Problem

Various companies are engaged in compiling histories of their leaders. But nearly every one so engaged tells me the same story: "The biggest difficulty I have faced has been lack of any adequate bibliographies. There is *not one* popular biography of any electric utility founder or subsequent operator listed."

Suggestions

Unless the industry acts promptly, the biggest opportunity to corral information on pioneering utility leaders will be lost.

My suggestion follows: (1) Let the industry select some central reference bureau—library, A.E.I.C., or E.E.I.—as a repository for all records of pioneering leaders; (2) Let the industry establish a fund to provide suitable storage and filing of those reference records; (3) Let E.E.I., A.E.I.C., A.I.E.E., ELECTRICAL WORLD and each company urge individuals to send the original material or a copy to the selected reference repository. Particularly will it be necessary for each company to urge the survivors of deceased pioneers to send such records before they are lost to the world, as some are already.

ELECTRICAL WORLD can do a lot to start such a movement, if popular. And it shouldn't forget those pioneers who never attained executive rank who contributed to the evolution of research, invention, construction and operation,

Plan now
FOR
OSMOPLASTIC
Groundline Treatment
In your Spring Maintenance Budget

•

Pennsylvania Utilities have treated over 75,000 poles with Osmoplastic since 1935! Names on request.

•

Many leading utility companies have discovered that by incorporating the Osmoplastic Groundline Treatment in their maintenance work the service life of their standing poles can be extended many years—at a cost per pole year of only 10 to 20 cents.

OSMOSE WOOD PRESERVING CO.
OF AMERICA, Inc.
General Offices, 1437 Bailey Ave., Buffalo, N. Y.

THERMOLAIN by STAR
for RADIANTS
RANGES
IRONS

Here's a heat resistant porcelain with exceptional strength, developed to withstand sudden thermal changes. If you're having trouble with breaking, chipping or cracking, put it up to STAR THERMOLAIN. Used extensively also for rheostats and immersion heaters. Send blueprints.

The STAR PORCELAIN COMPANY
51 Muirhead Ave. Trenton, N. J.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on box Numbers.)

Positions Wanted (full or part-time salaried employment only), one-half the above rates.

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INFORMATION:

Box Numbers in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E.W.

NEW ADVERTISEMENTS received by 10 A. M. February 17th will appear in the February 22nd issue subject to limitations of space available.

POSITIONS VACANT

MECHANICAL ENGINEERING DRAFTSMAN wanted, experienced in power house design. Should have 6 to 8 years experience in layout work on equipment, piping and mechanical details. Location approximately 100 miles from Philadelphia, Pennsylvania. P-858, Electrical World, 330 W. 42nd St., New York, N. Y.

LIGHTING ENGINEER WANTED, qualified to design and recommend suitable lighting and fixtures for large installations. Applicant should be engineering graduate, preferably with special training in this field. Knowledge of fixture market and lighting standards is essential. Application should cover experience in detail and salary desired. Location Southern Atlantic State. P-862, Electrical World, 330 W. 42nd St., New York, N. Y.

JUNIOR ELECTRICAL ENGINEERING DRAFTSMAN wanted, preferably under 35 with experience in substation design. Salary in accordance with experience. Location approximately 100 miles from Philadelphia, Pennsylvania. P-859, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 positions may contact employers through our confidential services, established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

COYNE ELECTRICAL SCHOOL GRADUATE age 23 for Electrical Maintenance, trouble-shooting, Repairing on all types Industrial Equipment including Switchboards and operation. PW-860, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

MANAGER POWER SALES—Present responsibilities include negotiating large power contracts, customer and public relations. Basic experience in rate design, distribution engineering and construction supervision. Will consider management of small utility. Graduate E.E. Age 38. PW-863, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

MAN age 36. With 16 years experience in Hydro Power Plant Engineering. 5 years with U. S. Government. Wants position as Engineer or assistant to Engineer in Municipal or Power Company or Manufacturing Company. Will take job anywhere. It must be regular work. PW-865, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER licensed, experienced in power plant, substation, transmission and distribution design. Familiar with operating problems of all. Now employed desires change. PW-866, Electrical World, 330 W. 42nd St., New York, N. Y.

OPERATING MANAGER: Capable and able to take complete charge of system:—generation, distribution, rates, accounting, and general engineering. 13 years of diversified electric and water experience. E.E. graduate, G.E. Test Course. Now employed. PW-867, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

(POSITION VACANT)

POWER ENGINEER

Large industrial company with chemical plant in the East has opening for experienced Central Station Engineer. Applicants should have preferably a Bachelor of Science degree in Electrical Engineering and 10 years or more of practical experience in the design, construction, operation and maintenance of high pressure steam generation and of electric power stations.

Reply, in confidence, giving full details of your training, experience and special qualifications, state nationality and salary requested and attach small photograph. Our own staff is advised of this advertisement.

P-856, Electrical World, 330 W. 42nd St., New York City

POSITIONS WANTED

ELECTRIC UTILITY EXECUTIVE. Graduate M.E., age 42, 20 years experience with two companies including supervision central stations, Electric transmission system operation, distribution, water and bus departments. Understand related labor and management problems. Employed. Desire change for greater responsibility. References. PW-857, Electrical World, 330 W. 42nd St., New York, N. Y.

GRADUATE ELECTRICAL ENGINEER, experience in transformer and electric utility engineering design, also in drafting supervision and checking. PW-864, Electrical World, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

MANUFACTURERS AGENT for the states of Maryland, District of Columbia and Virginia, established 20 years, has opening for two lines. RA-861, Electrical World, 330 W. 42nd St., New York, N. Y.

Used Equipment Advertising See Opposite Page → → →

"I get some very nice inquiries through my ELECTRICAL WORLD advertising"

The foregoing is quoted as the comment of a dealer in used equipment whose advertising frequently appears in "Searchlight". The reason he "gets some very nice inquiries" is because—in the Searchlight Section of ELECTRICAL WORLD—the advertising comes to the attention of equipment buyers throughout the industry.

Have you equipment for sale? If so, why not let this "Searchlight" advertising help you find buyers?

Departmental Advertising Staff
ELECTRICAL WORLD

on whose past and present efforts the success of the industry rested and continues to depend.

Then, and only then, can writers, who are so inclined and qualified, convert into condensed popular form the human-interest story of leaders whose records will otherwise become hazier and hazier as time passes.

Let's start the monument to pioneers now! Present pioneers can then be honored in their turn more easily.

ALLEN M. PERRY,
Consultant and Historian,
New York City.

•

Municipal Plants

CHARLESTON, MO.—Mayor W. R. McCracken has announced that a new election will be called soon on the $150,000 bonds for a municipal light and power plant and distribution system which was defeated at the special election held on December 31.

COLUMBUS, OHIO—By agreement between City Attorney John L. Davies and counsel for the Columbus & Southern Ohio Electric Co., the Franklin County Common Pleas Court will be asked to appoint a special master to expedite an early conclusion of the disagreement between the city and the utility over the proposed $1,000,000 expansion of the municipal light plant. Reply of the utility to the city's brief in connection with the defense of the $1,000,000 extension, which has been the subject of litigation since 1933, was filed in the common pleas court recently. The proposed light plant expansion was voted by the electorate in 1933. Just before the city was ready to begin construction, the Columbus & Southern Ohio Electric Co. first brought suit in the federal court, and, losing there, went into Common Pleas Court, then to the Court of Appeals, then to the Ohio Supreme Court, and now the case is back again in Common Pleas Court.

NORTH BALTIMORE, OHIO—Court of Appeals at Toledo recently found in favor of the village in its fight with the Central Ohio Light & Power Co. over the proposed construction of a municipal light plant. There have been numerous legal actions in the controversy, one of which reached the Ohio Supreme Court, and several the Court of Appeals. The utility sought an injunction restraining North Baltimore from issuing and selling mortgage revenue bonds to raise funds to build its own power plant and from entering into any contracts to build the plant, which, it is estimated, will cost $214,821. The government was to contribute $87,000 as its share of the cost. The Court of Appeals ordered the company's petition dissolved, affirming the opinion of the Wood County Common Pleas Court, which ruled the village had authority to issue the bonds.

•

Buys S. A. Cook & Co. Plants

Niagara Lockport & Ontario Power Co. has purchased one of the plants of S. A. Cook & Co. in Medina, N. Y. This is part of the company's expansion program.

J. L. HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
1600-1604 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: PAlisade 6-2600
HOWARD B. JOHNSON, 53 W. Jackson Blvd., Chicago, Ill., Chicago Representative

MOTOR GENERATOR SETS

1—500-kw., 250/125 volt, G.E., Synchronous.
1—500-kw., 600 volt, General Electric, Synchronous.
2—500-kw., 250 volt, General Electric, Synchronous.
1—150-kw., 250-V., Westinghouse, Synchronous.
1—100-kw., 250-V., Synchronous.
1— 75-kw., 125-V., Crocker-Wheeler, Synchronous.
1— 50-kw., 125-V., G. E., Sq. Cage.
1— 50-kw., 250-V., G.E., Sq. Cage.
1— 40-kw., 125-V., Westinghouse, Synchronous.
1— 35-kw., 125/250-V., General Electric, Sq. Cage.
2— 30-kw., 32 volt, ball bearing, squirrel cage.

TURBINES

3—1000 kw., 2300 volt, condensing.
1—500 kw., General Electric, 3 phase, 60 cycle, 480 volt bleeder.
1—300-kw., 3 phase, 60 cycle, 220 volt, General Electric, condensing.
1—250-kw., Westinghouse, 3 phase, 60 cycle, non-condensing.
1—200-kw., General Electric, condensing.
2—150-kw., Westinghouse, 125/250 v., non-condens.

TRANSFORMERS

1—15,000-kva., Pittsburgh, 3 phase, 26,000/4150 v.
3—400-kva., Wagner, 2200/220-440 volts.
3—400-kva., Moloney, 4150/2400-220/440 volts.
4—300-kva., Pittsburgh, 4600/115/230 volts.
4—200-kva., Pittsburgh, 7800/220/110 volts.
2—200-kva., General Electric, 2200/220/440 volts.
3—150-kva., Pittsburgh, 6600/440 volts.
2—150-kva., West. 2300/330/115-V. Scott Taps.
3—150-kva., General Electric, 33,000/2300 volts.
6—100-kva., Wagner, 2200/220-110 volts.
3— 75-kva., Pittsburgh, 2400/120 volts.
2— 50-kva., General Electric, 2200-220/110 volts.
2— 50-kva., Kuhlman, 2200/110-220 volts.
3—37½ kva., General Electric, 2400-240/120-V.
3—25-kva., Paranol cooled, 2200-220/110 volts.
3—25-kva., Westinghouse, 440/220-220/110 volts.

MOTORS—3 PHASE, 60 CYCLE

No.	H.P.	R.P.M.	Volts	Type
1	720	360	440	G.E. Syn.
1	500	450	2300/4000	G.E. Sl. Rg.
1	400	514	440	West. Sl. Rg.
1	350	300	440	G.E. Sl. Rg.
1	350	100	220	G.E. Syn.
2	335	600	2200	G.E. Syn.
1	300	600	2200	G.E. Sl. Rg.
1	250	450	440	G.E. Sl. Rg.

Variable Speed 230 Volt Motors

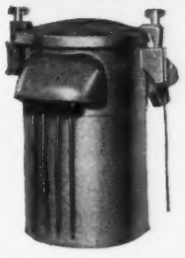
H.P.	R.P.M.	Type
1—150	300/900	Westinghouse
90	470/940	G.E.
75	235/950	Burke
35	500/1500	G.E.
30	600/1200	West.
25	300/1200	G.E.
4— 20	400/1200	G.E.
3— 15	300/1200	G.E.

ENGINE SETS

21x24 Ames Uniflow, direct connected 250 KW, 3 phase G.E. Generator.
13x15 Skinner Uniflow, 150/300 RPM, engine only.
16x36, Hamilton Corliss, heavy-duty, with 165 KW, 3 phase, 220 volt General Electric Generator.

Complete Line of A.C. and D.C. Motors and Generators

-TRANSFORMERS-



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4—667 KVA Pittsburgh Transformers, 60 cycle, 11000–2300 volts **$1050.00 EACH**

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 135-A

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

GUARANTEED REBUILT EQUIPMENT
What you need, When you need it, And at Half the cost of new.

SYN. CONDENSER
1000 KVA Westinghouse 3/60/480 v. 900 RPM, over 4½ million serial, with dir-con. exciter, manual reduced voltage panel.

SQUIRREL CAGE
2—350 HP NEW Elliott motors 3/60/2200 v. 3540 RPM, 40-deg. pressure lub. ped. bearings with C. H. auto. reduced voltage oil type stg. panel.

MOTOR-GENERATOR SETS
500 KW GE 3-brg. MPC 600 v dc 720 RPM.
400 KW—2-200 KW 275 v dc 1200 RPM.
300 KW GE 275 v. induction, 720 RPM.
2—300 KW GE 600 v DC syn. 720 RPM.
200 KW Wtg. 275 v. DC. syn. 900 RPM
150 KW Wtg. 275 v. DC. syn. 900 RPM.
150 KW GE. 600 v. dc. syn. 1200 RPM
150 KW Wtg. 275 v. DC. syn. 1200 RPM

A.C. GENERATORS
1000 KVA Wtg. syn. cond. 440 v. 900 RPM.
560 KVA G.E. ATI 4400/440 720 RPM.
450 KVA G.E. ATI 2200/440 v. 720 RPM.
300 KVA G.E. 480 v. 900 RPM syn. cond.
240 KVA Wtg. 480 v. 600 RPM.
2—200 KVA G.E. 480/240 v. 720 RPM.
175 KVA Wtg. 2200 v. 900 RPM.
160 KVA Wtg. 2200/440 v. 225 RPM.
150 KVA W.E., 220 v. 900 RPM.
150 KVA G.E. 2200 v. 600 RPM.

CHICAGO ELECTRIC COMPANY
1314 WEST 22ND STREET CHICAGO

Your Inquiry Will Have Special Value

if you mention that it is in response to advertising in this publication. Advertisers value such acknowledgments highly; so does the publisher. You benefit—as a reader—in the enlarged future service such acknowledgments help to make possible.

RE-NU-BILT MOTORS GENERATORS TRANSFORMERS LARGE & HEAVY ELECTRIC POWER EQUIPMENT

Thoroughly Tested Before Shipment and Guaranteed

MORE THAN 50% SAVING

BELYEA CO. INC.
61 HOWELL STREET
JERSEY CITY, NEW JERSEY

ADVERTISING IN THIS ISSUE

To save time and money—your time and your money—that's the purpose of the many products and services advertised in this issue of Electrical World. Check through the advertising pages for information that can be of direct benefit to you.

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★ These companies have supplied additional buying information on their products in the 1941 edition of the Electrical Buyers' Reference.